AD-A153 395 1984 ANNUAL TROPICAL CYCLONE REPORT(U) NAVAL OCEANOGRAPHY COMMAND CENTER/JOINT TYPHOON WARNING CENTER FPO SAN FRANCISCO 96630 K G HINMAN ET AL. 1984 1/3

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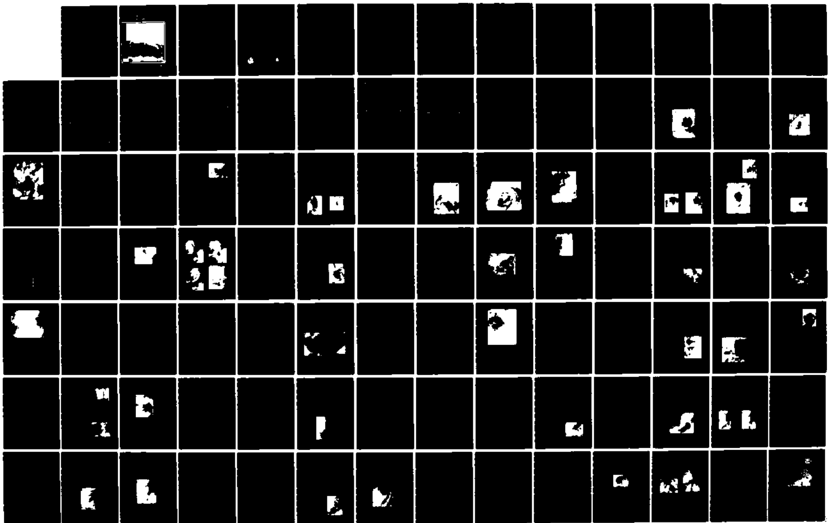

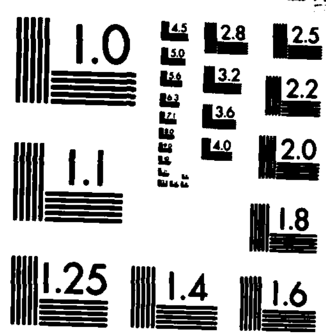

MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A

(12)

1984 ANNUAL TROPICAL CYCLONE REPORT

JOINT TYPHOON WARNING CENTER
GUAM, MARIANA ISLANDS

85 4 [illegible]

FRONT COVER: A synoptic view of Tropical Cyclone 30S (Kamisy) taken on 8 April 1984 by Space Shuttle Mission 41C. Kamisy was located east-northeast of Madagascar with an estimated intensity of 100 kt (51 m/s). This photograph was taken with a 100mm lens from an altitude of 260 nm (482 km). Note the convergent banding well away from the eye. The cirrus outflow is extremely strong partially obscuring the near field image. (Photograph provided by LCDR W. T. Aldinger, NAVPOLAROCEANCEN Detachment, Johnson Space Center, Texas).

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FOREWARD

The Annual Tropical Cyclone Report is prepared by the staff of the Joint Typhoon Warning Center (JTWC), a combined USAF/USN organization operating under the command of the Commanding Officer, U. S. Naval Oceanography Command Center/ Joint Typhoon Warning Center, Guam. JTWC was established in April 1959 when USCINCPAC directed USCINCPACFLT to provide a single tropical cyclone warning center for the western North Pacific region. The operations of JTWC are guided by CINCPACINST 3140.1 (series).

The mission of the Joint Typhoon Warning Center is multi-faceted and includes:

1. Continuous monitoring of all tropical weather activity in the Northern and Southern Hemispheres, from 180 degrees longitude westward to the east coast of Africa, and the prompt issuance of appropriate advisories and alerts when tropical cyclone development is anticipated.

2. Issuing warnings on all significant tropical cyclones in the above area of responsibility.

3. Determination of reconnaissance requirements for tropical cyclone surveillance and assignment of appropriate priorities.

4. In depth post-storm analysis of all tropical cyclones occurring within the western North Pacific and North Indian Oceans for publication in this report.

5. Cooperation with the Naval Environmental Prediction Research Facility, Monterey, California, on the operational evaluation of tropical cyclone models and forecast aids, and the development of new techniques to support operational forecast scenarios.

Satellite imagery used throughout this report represents data obtained by the tropical cyclone satellite surveillance network. The personnel of Detachment 1, 1WW, colocated with JTWC at Nimitz Hill, Guam, coordinate the satellite aquisitions and tropical cyclone surveillance with the following units:

Det 5, 1WW, Clark AB, RP

Det 8, 1WW, Kadena AB, Japan

Det 15, 30WS, Osan AB, Korea

Det 4, 1WW, Hickam AFB, Hawaii

Air Force Global Weather Central, Offutt AFB, Nebraska

In addition, the Naval Oceanography Command Detachment, Diego Garcia, and DMSP equipped U.S. Navy aircraft carriers have been instrumental in providing vital satellite position fixes of tropical cyclones in the Indian Ocean.

Should JTWC become incapacitated, the Alternate Joint Typhoon Warning Center (AJTWC) located at the U. S. Naval Western Oceanography Center, Pearl Harbor, Hawaii, assumes warning responsibilities. Assistance in determining satellite reconnaissance requirements, and in obtaining the resultant data, is provided by Det 4, 1WW, Hickam AFB, Hawaii.

A special thanks is extended to the men and women of: 27th Information Systems Squadron, Operating Location C, for their continuing support by providing high quality real-time satellite imagery; the Pacific Fleet Audio-Visual Center, Guam, for their assistance in the reproduction of satellite and graphics data for this report; to the Navy Publications and Printing Service Branch Office, Guam, for their efforts to meet publication deadlines; and to Mrs. Patricia G. Lizama for her patience and perseverence in typing the many drafts and final manuscript of this report. A special thanks is also extended to SSGT Charles B. Siniff Jr. for gridding the numerous satellite pictures used in this report.

NOTE: Appendix V contains information on how to obtain past issues of the Annual Tropical Cyclone Report (titled Annual Typhoon Report prior to 1980).

TABLE OF CONTENTS

CHAPTER I - OPERATIONAL PROCEDURES

1. GENERAL

The Joint Typhoon Warning Center (JTWC) provides a variety of routine services to the organizations within its area of responsibility, including:

a. Significant Tropical Weather Advisories: issued daily, this product describes all tropical disturbances and assesses their potential for further development during the advisory period;

b. Tropical Cyclone Formation Alerts: issued when synoptic, satellite and/or aircraft reconnaissance data indicates development of a significant tropical cyclone in a specified area is likely;

c. Tropical Cyclone Warnings: issued periodically throughout each day for significant tropical cyclones, giving forecasts of position and intensity of the system; and

d. Prognostic Reasoning Messages: issued twice daily for tropical storms and typhoons in the western North Pacific; these messages discuss the rationale behind the most recent JTWC warnings.

The recipients of the services of JTWC essentially determine the content of JTWC's products according to their ever-changing requirements. Therefore, the spectrum of routine services is subject to change from year to year. Such changes are usually the result of deliberations held at the Annual Tropical Cyclone Conference.

2. DATA SOURCES

a. COMPUTER PRODUCTS:

A standard array of synoptic-scale computer analyses and prognostic charts are available from the Fleet Numerical Oceanography Center (FLENUMOCEANCEN) at Monterey, California. These products are provided to JTWC via the Naval Environmental Data Network (NEDN).

b. CONVENTIONAL DATA:

This data set is comprised of land-based and shipboard surface and upper-air observations taken at or near synoptic times, cloud-motion winds derived twice daily from satellite data, and enroute meteorological observations from commercial and military aircraft (AIREPS) within six hours of synoptic times. Conventional data charts are prepared daily at 0000Z and 1200Z using hand- and computer-plotted data for the surface/gradient and 200 mb (upper-tropospheric) levels. In addition to these analyses, charts at the 850, 700, and 500 mb levels are computer-plotted from rawinsonde/pibal observations at the 12-hour synoptic times.

c. AIRCRAFT RECONNAISSANCE:

Aircraft weather reconnaissance data are invaluable for locating the position of the center of developing systems and essential for the accurate determination of numerous parameters, including;

- maximum surface and flight level wind
- minimum sea-level pressure
- horizontal surface and flight level wind distribution
- eye/center temperature and dewpoint

In addition wind and pressure-height data at the 500 and/or 400 mb levels, provided by the aircraft while enroute to, or from fix missions, or during dedicated synoptic-scale flights, provide a valuable supplement to the all too sparse data fields of JTWC's area of responsibility. A more detailed discussion of aircraft weather reconnaissance is presented in Chapter II.

d. SATELLITE RECONNAISSANCE:

Meteorological satellite data obtained from the Defense Meteorological Satellite Program (DMSP) and National Oceanic and Atmospheric Administration (NOAA) spacecraft played a major role in the early detection and tracking of tropical cyclones in 1984. A discussion of the role of these programs is presented in Chapter II.

e. RADAR RECONNAISSANCE:

During 1984, as in previous years, land-based radar coverage was utilized extensively when available. Once a tropical cyclone moved within the range of land-based radar sites, their reports were essential for determination of small scale movement. Use of radar reports during 1984 is discussed in Chapter II.

3. COMMUNICATIONS

a. JTWC currently has access to three primary communications circuits.

(1) The Automated Digital Network (AUTODIN) is used for dissemination of warnings, alerts and other related bulletins to Department of Defense installations. These messages are relayed for further transmission over U.S. Navy Fleet Broadcasts, and U.S. Coast Guard CW (continuous wave Morse Code) and voice broadcasts. Inbound message traffic for JTWC is received via AUTODIN addressed to NAVOCEANCOMCEN GUAM, JTWC GUAM, or DET 1 1WW NIMITZ HILL GU.

(2) The Air Force Automated Weather Network (AWN) provides weather data to JTWC through a dedicated circuit from the Automated Digital Weather Switch (ADWS) at Hickam AFB, Hawaii. The ADWS selects and

routes the large volume of meteorological reports necessary to satisfy JTWC requirements for the right data at the right time. Weather bulletins prepared by JTWC are inserted into the AWN circuit via the NEDS and the Nimitz Hill Naval Telecommunications Center (NTCC) of the Naval Communications Area Master Station Western Pacific.

(3) The Naval Environmental Data Network (NEDN) is the communications link with the computers at FLENUMOCEANCEN. JTWC is able to receive environmental data from FLENUMOCEANCEN and to access the computers directly to execute numerical techniques.

b. The Naval Environmental Display Station (NEDS) has become the backbone of the JTWC communications system. It is the terminal that provides a direct interface with the NEDN and AWN circuits, and is capable of preparing messages for indirect AUTODIN transmission. The NEDS also provides a means for the Typhoon Duty Officer (TDO) to request forecast aids which are processed on the FLENUMOCEANCEN computers and transmitted to the TDO over the NEDN circuit.

4. ANALYSES

A composite surface/gradient level (3000 ft (915 m)) manual analysis of the JTWC area of responsibility is accomplished on the 0000Z and 1200Z conventional data. Analysis of the wind field using streamlines is stressed for tropical and subtropical regions. Analysis of the pressure field is accomplished routinely by the Naval Oceanography Command Center (NOCC) Operations watch-team and is used by JTWC in conjunction with their analysis of the tropical wind fields.

A composite upper-tropospheric manual streamline analysis is accomplished daily utilizing rawinsonde data from 300 mb through 100 mb, winds derived from cloud motion analysis, and AIREPS (taken plus or minus 6 hours of chart valid time) at or above 29,000 feet (8,839 m). Wind and height data are used to generate a representative analysis of tropical cyclone outflow patterns, mid-latitude steering currents, and features that may influence tropical cyclone intensity. All charts are hand-plotted in the tropics to provide all available data as soon as possible to the TDO. These charts are augmented by computer-plotted charts for the final analysis.

Computer plotted charts for the 850, 700, and 500 mb levels are available for streamline and/or height-change analysis from the 0000Z and 1200Z data base. Additional sectional charts at intermediate synoptic times and auxilary charts such as station-time plot diagrams and pressure-change charts are also analyzed during periods of significant tropical cyclone activity.

5. FORECAST AIDS

The following objective techniques were employed in tropical cyclone forecasting during 1984 (a description of these techniques is presented in Chapter IV):

a. MOVEMENT

(1) 12-HOUR EXTRAPOLATION

(2) CLIMATOLOGY

(3) TPAC (Extrapolation and Climatology Blend)

(4) TYAN78 (Analog)

(5) COSMOS (Model Output Statistics)

(6) OTCM (Dynamical Model)

(7) NTCM (Nested Grid Dynamical Model)

(8) TAPT (Empirical)

b. INTENSITY

(1) THETA E (Empirical)

(2) DVORAK (Empirical)

(3) CLIMATOLOGY

(4) WIND RADIUS (Analytical)

6. FORECAST PROCEDURES

a. INITIAL POSITIONING

The warning position is the best estimate of the center of the surface circulation at synoptic time. It is estimated from an analysis of all fix information received up to one and one-half hours after synoptic time. This analysis is based on a semi-objective weighting of fix information based on the historical accuracy of the fix platform and the meteorological features used for the fix. The interpolated warning position reduces the weighting of any single fix and results in a more consistent movement and a warning position that is more representative of the larger-scale circulation. If the fix data is not available due to reconnaissance platform malfunctions or communication problems, synoptic data or extrapolation from previous fixes are used.

b. TRACK FORECASTING

A preliminary forecast track is developed based on an evaluation of the rationale behind the previous warning and the guidance given by the most recent set of objective techniques and numerical prognoses. This preliminary track is then subjectively modified based on the following considerations:

(1) The prospects for recurvature or erratic movement are evaluated. This evaluation is based primarily on the present and forecast positions and amplitudes of the middle-tropospheric, mid-latitude troughs and ridges as depicted on the latest upper-air analysis and numerical forecasts.

(2) Determination of the best steering level is partly influenced by the maturity and vertical extent of the tropical cyclone. For mature tropical cyclones located south of the subtropical ridge, forecast changes in speed of movement are closely correlated with anticipated changes in the intensity or relative position of the ridge. When steering currents are relatively weak, the tendency for tropical cyclones to move northward due to internal forces is an important consideration.

(3) Over the 12- to 72-hour forecast period, speed of movement during the early forecast period is usually biased towards persistence, while the subsequent forecast periods are biased toward objective techniques. When a tropical cyclone moves poleward, and toward the mid-latitude steering currents, speed of movement becomes increasingly more biased toward a selective group of objective techniques capable of estimating significant increases in speed of movement.

(4) The proximity of the tropical cyclone to other tropical cyclones is closely evaluated to determine if there is a possibility of interaction.

A final check is made against climatology to determine whether the forecast track is reasonable. If the forecast deviates greatly from one of the climatological tracks, the forecast rationale may be reappraised.

c. INTENSITY FORECASTING

In this parameter, heavy reliance is placed on intensity trends from aircraft reconnaissance reports, wind and pressure data from ships and land stations in the vicinity of the tropical cyclone, the Dvorak satellite empirical model and climatology. An evaluation of the entire synoptic situation is made, including the location of major troughs and ridges, the position and intensity of any nearby tropical upper-tropospheric troughs (TUTT's), the vertical and horizontal extent of the tropical cyclone's circulation and the extent of the associated upper-level outflow pattern. An essential element affecting each intensity forecast is the accompanying forecast track and the influence of environmental parameters along that track, such as terrain influences, vertical wind shear, and the existence of an extratropical environment.

Once the forecast intensities have been derived, the horizontal distribution of surface winds (winds greater than 30-, 50-, and 100-knots) is determined. The most recent wind radii and associated asymmetrics are deduced from all available surface wind observations and reconnaissance aircraft reports. Based on the current surface wind distribution, preliminary estimates of future wind radii are provided by an empirically derived objective technique. These estimates may be subjectively modified based upon the anticipated interaction of the tropical cyclone's circulation with forecast locations of large-scale wind regimes and significant landmasses. Other factors including the tropical cyclone's speed of movement and possible extratropical transition are considered.

7. WARNINGS

Tropical cyclone warnings are issued when a closed circulation is evident and maximum sustained winds are forecast to increase to 34 knots (18 meters per second) within 48 hours, or if the tropical cyclone is in such a position that life or property may be endangered within 72 hours. Warnings may also be issued in other situations if it is determined that there is a need to alert military or civil interests to conditions which may become hazardous in a short period of time.

Each tropical cyclone warning is numbered sequentially and includes the following information: the position of the surface center; estimate of the position accuracy and the supporting reconnaissance (fix) platforms; the direction and speed of movement during the past six hours; and the intensity and radial extent of surface winds over 30-, 50-, and 100-knots, when applicable. At forecast intervals of 12-, 24-, 48-, and 72-hours, information on the tropical cyclone's anticipated position, intensity and wind radii are also provided. Starting on 1 July 1984, vectors indicating the mean direction and mean speed between forecast positions were also included in all warnings.

Warnings in the western North Pacific and North Indian Ocean are issued every six hours valid at standard times (0000Z, 0600Z, 1200Z, and 1800Z). All warnings are released to the communications network no earlier than synoptic time and no later than synoptic time plus two and one-half hours so that recipients will have a reasonable expectation of having all warnings "in hand" by synoptic time plus three hours (0300Z, 0900Z, 1500Z, and 2100Z).

Warning forecast positions are later verified against the corresponding "best track" positions (obtained during detailed post-storm analysis to determine the actual path of the cyclone). A summary of the verification results from 1984 is presented in Chapter IV.

8. PROGNOSTIC REASONING MESSAGES

For tropical storms and typhoons in the western North Pacific Ocean, prognostic reasoning messages are transmitted following the 0000Z and 1200Z warnings, or whenever the forecast reasoning is no longer valid. This plain language message is intended to provide meteorologists with the reasoning behind the latest JTWC forecast.

In addition to this message, prognostic reasoning information applicable to all customers is provided in the remarks section of warnings when significant forecast changes are made or when deemed appropriate by the TDO.

9. TROPICAL CYCLONE FORMATION ALERT

Tropical Cyclone Formation Alerts (TCFAs) are issued whenever interpretation of satellite imagery and other meteorological data indicates that the formation of a significant tropical cyclone is likely. These formation alerts will specify a valid period not to exceed 24 hours and must either be cancelled, reissued, or superseded by a tropical cyclone warning prior to the expiration of the valid time.

10. SIGNIFICANT TROPICAL WEATHER ADVISORY

This product contains a general, nontechnical description of all tropical disturbances in the JTWC area of responsibility and an assessment of their potential for further (tropical cyclone) development. In addition, all tropical cyclones in warning status are briefly discussed. This message is issued at 0600Z daily and is valid for a 24 hour period. It is reissued whenever the situation warrants. For each suspect area, the words "poor", "fair", and "good" will be used to describe the potential for further development. "Poor" will be used to describe a tropical disturbance that is not expected to require a TCFA during the advisory period; "Fair" will be used to describe a tropical disturbance that is currently not covered by a TCFA, but for which it is likely that a TCFA will be issued during the advisory period; and "Good" will be used when the tropical disturbance is covered by a TCFA.

CHAPTER II - RECONNAISSANCE AND FIXES

1. GENERAL

The Joint Typhoon Warning Center depends on reconnaissance to provide necessary, accurate, and timely meteorological information in support of each warning. JTWC relies primarily on three reconnaissance platforms: aircraft, satellite, and radar. In data rich areas synoptic data are also used to supplement the above. Optimum utilization of all available reconnaissance resources is obtained through the Selective Reconnaissance Program (SRP); various factors are considered in selecting a specific reconnaissance platform including capabilities and limitations, and the tropical cyclone's threat to life and property both afloat and ashore. A summary of reconnaissance fixes received during 1984 is included in Section 6 of this chapter.

2. RECONNAISSANCE AVAILABILITY

a. Aircraft

Aircraft weather reconnaissance for the JTWC is performed by the 54th Weather Reconnaissance Squadron (54th WRS) located at Andersen Air Force Base, Guam. The 54th WRS is presently equipped with six WC-130 aircraft and, from July through October, is augmented by three additional aircraft from the 53rd WRS, Keesler Air Force Base, Mississippi, bringing the total number of available aircraft to nine. The JTWC reconnaissance requirements are provided daily to the Tropical Cyclone Aircraft Reconnaissance Coordinator (TCARC), who marries the tasking from the JTWC with the available airframes from the 54th WRS.

As in previous years, aircraft reconnaissance provided direct measurements of height, temperature, flight-level winds, sea-level pressure, estimated surface winds (when observable), and numerous additional parameters. The meteorological data are gathered by the Aerial Reconnaissance Weather Officer (ARWO) and dropsonde operators of Detachment 3, 1st Weather Wing who fly with the 54th WRS. These data provide the Typhoon Duty Officer (TDO) with indications of changing tropical cyclone characteristics, radii of associated winds and current tropical cyclone position and intensity. Another important aspect is the availability of the data for research on tropical cyclone analysis and forecasting.

b. Satellite

Satellite fixes from USAF/USN ground sites and USN ships provide day and night coverage in the JTWC area of responsibility. Interpretation of this satellite imagery provides tropical cyclone positions and estimates of current and forecast intensities through the Dvorak technique.

c. Radar

Land radar provides positioning data on well developed tropical cyclones when in the proximity (usually within 175 nm (324 km)) of the radar sites in the Philippines, Taiwan, Hong Kong, Japan, South Korea, Kwajalein, and Guam.

d. Synoptic

In 1984 JTWC also determined tropical cyclone positions based on the analysis of the surface/gradient level synoptic data. These positions were helpful in situations where the vertical structure of the tropical cyclone was weak or accurate surface positions from aircraft or satellite were not available.

3. AIRCRAFT RECONNAISSANCE SUMMARY

During the 1984 tropical cyclone season, the JTWC levied 210 vortex fixes and 53 investigative missions of which 14 were flown into disturbances which did not develop. In addition to the levied fixes, 251 intermediate fixes were also obtained. The average vector error for all aircraft fixes received at the JTWC during 1984 was 12 nm (22 km).

Aircraft reconnaissance effectiveness is summarized in Table 2-1 using the criteria set forth in CINCPACINST 3140.1 (series).

TABLE 2-1. AIRCRAFT RECONNAISSANCE EFFECTIVENESS

EFFECTIVENESS	NUMBER OF LEVIED FIXES	PERCENT
COMPLETED ON TIME	202	96.1
EARLY	2	1.0
LATE	4	1.9
MISSED	2	1.0
TOTAL	210	100.0

LEVIED VS. MISSED FIXES

	LEVIED	MISSED	PERCENT
AVERAGE 1965-1970	507	10	2.0
1971	802	61	7.6
1972	624	126	20.2
1973	227	13	5.7
1974	358	30	8.4
1975	217	7	3.2
1976	317	11	3.5
1977	203	3	1.5
1978	290	2	0.7
1979	289	14	4.8
1980	213	4	1.9
1981	201	3	1.5
1982	276	17	6.2
1983	157	3	1.9
1984	210	2	1.0

4. SATELLITE RECONNAISSANCE SUMMARY

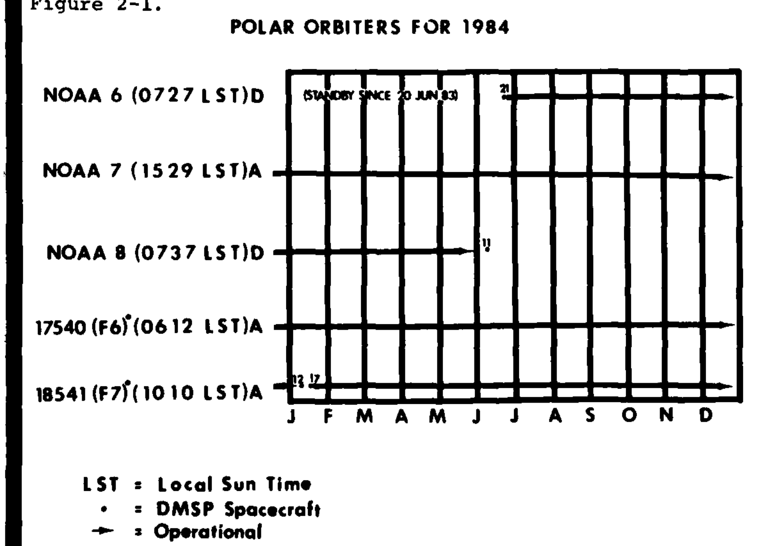
The Air Force provides satellite reconnaissance support to JTWC using imagery from a variety of spacecraft. The tropical cyclone satellite surveillance network consists of both tactical and centralized facilities. Tactical DMSP sites are located at Nimitz Hill, Guam; Clark AB, Republic of the Philippines; Kadena AB, Japan; Osan AB, Korea; and Hickam AFB, Hawaii. These sites provide a combined coverage that includes most of the JTWC area of responsibility in the western North Pacific from near the dateline westward to the Malay Peninsula. JTWC relies on the Air Force Global Weather Central (AFGWC) to provide coverage over the remainder of its area of responsibility using stored satellite data. The Naval Oceanography Command Detachment, Diego Garcia, provides NOAA polar orbiting coverage in the central Indian Ocean as a supplement to this support. U. S. Navy ships equipped for direct readout also provided supplementary support.

AFGWC, located at Offutt AFB, Nebraska, is the centralized member of the tropical cyclone satellite surveillance network. In support of JTWC, AFGWC processes stored imagery from DMSP and NOAA spacecraft. Imagery processed at AFGWC is recorded onboard the spacecraft as it passes over the earth. Later, these data are downlinked to AFGWC via a network of command/readout sites and communication satellites. This enables AFGWC to obtain the coverage necessary to fix all tropical systems of interest to JTWC. AFGWC has the primary responsibility to provide tropical cyclone surveillance over the entire Indian Ocean, southwest Pacific, and portions of the western North Pacific on both sides of the dateline. Additionally, AFGWC can be tasked to provide tropical cyclone positions in the entire western North Pacific as backup to coverage routinely available in that region.

The hub of the network is Det 1, 1WW, colocated with JTWC on Nimitz Hill, Guam. Based on available satellite coverage, Det 1 coordinates satellite reconnaissance requirements with JTWC and tasks the individual network sites for the necessary tropical cyclone fixes. Therefore, when a position from a polar-orbiting satellite is required as the basis for a warning, called a "levied fix", a dual-site tasking concept can be applied. Under this concept, two sites are tasked to fix the tropical cyclone from the same satellite pass. This provides the necessary redundancy to virtually guarantee JTWC a successful satellite fix on the tropical cyclone. Using this dual-site concept, the satellite reconnaissance network is capable of meeting all of JTWC's levied satellite fix requirements.

The network provides JTWC with several products and services. The main service is one of surveillance. Each site reviews its daily satellite coverage for indications of tropical cyclone development. If an area exhibits the potential for development, JTWC is notified. Once JTWC issues either a formation alert or warning, the network is tasked to provide three products: tropical cyclone positions, intensity estimates, and 24-hour intensity forecasts. Satellite tropical cyclone positions are assigned position code numbers (PCN) depending on the availability of geography for precise gridding, and the degree of organization of the tropical cyclone's cloud system (Table 2-2). During 1984, the network provided JTWC with a total of 1971 satellite fixes on tropical systems in the western North Pacific. Another 184 fixes were made for tropical systems in the North Indian Ocean. A comparison of those fixes made on numbered tropical cyclones in the western North Pacific with their corresponding JTWC best track positions is shown in Table 2-3. Estimates of the tropical cyclone's current intensity and 24-hour intensity forecast are

Figure 2-1.



made once each day by applying the Dvorak technique (NOAA Technical Memorandum NESDIS 45 as revised) to visual imagery. A similar technique using enhanced infrared imagery is under development.

Four polar orbiters were available throughout the season. Figure 2-1 shows the status of operational polar orbiters. NOAA 6 was reactivated a year after being placed in standby mode (20 June 1983) to compensate for the untimely loss of NOAA 8. Although not shown NOAA 9 was successfully launched on 12 December and should be of benefit in 1985.

TABLE 2-2. POSITION CODE NUMBERS

PCN	METHOD OF CENTER DETERMINATION/GRIDDING
1	EYE/GEOGRAPHY
2	EYE/EPHEMERIS
3	WELL DEFINED CC/GEOGRAPHY
4	WELL DEFINED CC/EPHEMERIS
5	POORLY DEFINED CC/GEOGRAPHY
6	POORLY DEFINED CC/EPHEMERIS

5. RADAR RECONNAISSANCE SUMMARY

Fourteen of the 30 significant tropical cyclones in the western North Pacific during 1984 passed within range of land based radar with sufficient cloud pattern organization to be fixed. The land radar fixes that were obtained and transmitted to JTWC totaled 510. Two radar fixes were obtained by reconnaissance aircraft.

The WMO radar code defines three categories of accuracy: good (within 10 km (5nm)), fair (within 10 to 30 km (5 to 16 nm)), and poor (within 30 to 50 km (16 to 27nm)). This year 510 radar fixes were coded in this manner; 167 were good, 156 were fair, and 187 poor. Compared to the JTWC best track, the mean vector deviation for land radar sites was 20 nm (37 km). Excellent support through timely and accurate radar fix positioning allowed JTWC to track and forecast tropical cyclone movement through even the most difficult erratic tracks.

As in previous years, no radar reports were received on North Indian Ocean tropical cyclones.

6. TROPICAL CYCLONE FIX DATA

A total of 2918 fixes on 30 western North Pacific tropical cyclones and 193 fixes on four North Indian Ocean tropical cyclones were received at JTWC. Table 2-4, Fix Platform Summary, delineates the number of fixes per platform for each individual tropical cyclone. Season totals and percentages are also indicated.

Annex A includes individual fix data for each tropical cyclone. Fix data are divided into four categories: Satellite, Aircraft, Radar, and Synoptic. Those fixes labeled with an asterisk (*) were determined to be unrepresentative of the surface center and were not used in determining the best tracks. Within each category, the first three columns are as follows:

FIX NO. - Sequential fix number

TIME (Z) - GMT time in day, hours and minutes

FIX POSITION - Latitude and longitude to the nearest tenth of a degree

TABLE 2-3. MEAN DEVIATION (NM) OF ALL SATELLITE DERIVED TROPICAL CYCLONE POSITIONS FROM THE JTWC BEST TRACK POSITIONS. NUMBER OF CASES (IN PARENTHESES).

	WESTERN NORTH PACIFIC OCEAN				NORTH INDIAN OCEAN			
	1972-1983 AVERAGE		1984		1980-1983		1984	
PCN	(ALL SITES)		(ALL SITES)		(ALL SITES)		(ALL SITES)	
1	13.7	(1843)	12.4	(119)	16.2	(27)	17.8	(13)
2	17.3	(802)	15.7	(97)	9.0	(4)	32.1	(3)
3	20.3	(2691)	23.6	(259)	21.8	(11)	19.0	(2)
4	23.1	(999)	25.1	(134)	21.8	(5)	136.0	(3)
5	36.8	(4395)	43.6	(317)	33.1	(87)	36.5	(84)
6	40.9	(2298)	42.4	(265)	35.1	(83)	62.7	(23)
1&2	14.4	(2645)	13.9	(216)	15.5	(31)	20.5	(16)
3&4	20.9	(3690)	24.1	(393)	26.3	(16)	89.2	(5)
5&6	38.0	(6693)	43.0	(582)	32.2	(170)	42.2	(107)
TOTAL NUMBER OF CASES		(13028)		(1191)		(217)		(128)

TABLE 2-4. FIX PLATFORM SUMMARY FOR 1984

FIX PLATFORM SUMMARY

WESTERN NORTH PACIFIC	AIRCRAFT	SATELLITE	RADAR	SYNOPTIC	TOTAL
TS VERNON (01W)	--	26	--	--	26
TS WYNNE (02W)	23	103	37	3	166
TY ALEX (03W)	5	40	34	3	82
TS BETTY (04W)	2	62	31	--	95
TY CARY (05W)	29	85	--	--	114
TY DINAH (06W)	28	85	--	--	113
TY ED (07W)	19	82	102	--	203
TS FREDA (08W)	5	39	12	--	56
TD 09W (09W)	2	63	--	--	65
TS GERALD (10W)	9	68	52	3	132
TY HOLLY (11W)	21	81	117	1	220
TD 12W (12W)	2	19	--	--	21
TY IKE (13W)	33	110	38	3	184
TS JUNE (14W)	7	46	14	--	67
TY KELLY (15W)	11	57	--	--	68
TS LYNN (16W)	--	41	--	2	43
TS MAURY (17W)	13	23	--	--	36
TS NINA (18W)	2	34	2	--	38
TY OGDEN (19W)	9	42	--	--	51
TY PHYLLIS (20W)	10	37	--	--	47
TS ROY (21W)	6	26	--	--	32
TS SUSAN (22W)	--	26	--	--	26
TD 23W (23W)	1	11	--	--	12
TY THAD (24W)	14	60	--	--	74
STY VANESSA (25W)	27	114	13	--	154
TY WARREN (26W)	22	112	12	1	147
TY AGNES (27W)	19	108	4	--	131
STY BILL (28W)	46	163	44	--	253
TY CLARA (29W)	28	93	--	2	123
TY DOYLE (30W)	24	115	--	--	139
TOTAL	417	1971	512	18	2918
% OF TOTAL NR OF FIXES	14.3	67.6	17.5	.6	100.0

INDIAN OCEAN	SATELLITE	SYNOPTIC	TOTAL
TC 01A	18	--	18
TC 02B	40	2	42
TC 03B	37	3	40
TC 04B	89	4	93
TOTAL	184	9	193
% OF TOTAL NR OF FIXES	95.3	4.7	100.0

Depending upon the category, the remainder of the format varies as follows:

a. Satellite

(1) ACCRY - Position Code Number is used to indicate the accuracy of the fix position. A "1" or "2" indicates relatively high accuracy and a "5" or "6" relatively low accuracy.

(2) DVORAK CODE - Intensity evaluation and trend (Figure 2-2, Table 2-5). (For specifics, refer to NOAA TM; NESDIS - 45).

(3) COMMENTS - For explanation of abbreviations, see Appendix I.

(4) SITE - ICAO call sign of the specific satellite tracking station.

b. Aircraft

(1) FLT LVL - The constant pressure surface level, in millibars or altitude, in feet, maintained during the penetration. The normal level flow in developed tropical cyclones, due to turbulence factors, is 700 mb. Low-level missions are normally flown at 1500 ft (457 m).

(2) 700 MB HGT - Minimum height of the 700 mb pressure surface within the vortex recorded in meters.

(3) OBS MSLP - If the surface center can be visually detected (e.g., in the eye), the minimum sea-level pressure is obtained by a dropsonde release above the surface vortex center. If the fix is made at the 1500-foot level, the sea level pressure is extrapolated from that level.

(4) MAX-SFC-WND - The maximum surface wind (knots) is an estimate made by the ARWO based on sea state. This observation is limited to the region of the flight path and may not be representative of the entire tropical cyclone. Availability of data is also dependent upon the absence of undercast conditions and the presence of adequate illumination. The positions of the maximum flight level wind and the maximum observed surface wind do not necessarily coincide.

(5) MAX-FLT-LVL-WND - Wind speed (knots) at flight level is measured by the AN/APN 147 droppler radar system aboard the WC-130 aircraft. This measurement may not represent the maximum flight level wind associated with the tropical cyclone because the aircraft only samples those portions of the tropical cyclone along the flight path. In many instances, the flight path is through the weak sector of the tropical cyclone. In areas of heavy rainfall, the doppler radar may track energy reflected from precipitation rather than from the sea surface, thus, preventing accurate wind speed measurement. In obvious cases, such erroneous wind data will not be reported. In addition, the doppler radar system on the WC-130 restricts wind measurements to drift angles less than or equal to 27 degrees if the wind is normal (perpendicular) to the aircraft heading.

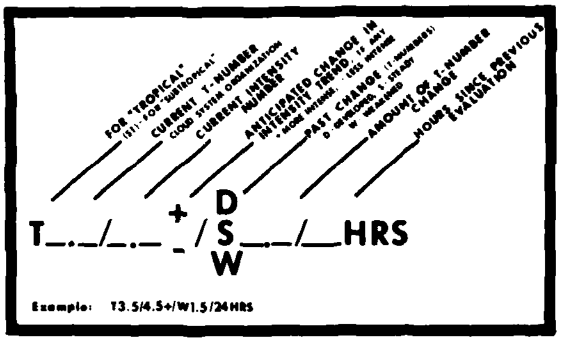


Figure 2-2. The current T-number is 3.5 but the current intensity estimate is 4.5 (equivalent to 77 kt). The cloud system has weakened by 1.5 T-numbers since the previous evaluation conducted 24 hours earlier. The plus (+) symbol indicates an expected reversal of the weakening trend or very little further weakening of the tropical cyclone during the next 24-hour period.

TABLE 2-5. MAXIMUM SUSTAINED WIND SPEED (KT) AS A FUNCTION OF DVORAK CI & FI (CURRENT & FORECAST INTENSITY) NUMBER AND MINIMUM SEA LEVEL PRESSURE (MSLP)

TROPICAL CYCLONE INTENSITY NUMBER	WIND SPEED	MSLP (NW PACIFIC)
0.0	<25	--
0.5	25	--
1.0	25	--
1.5	25	--
2.0	30	1003
2.5	35	999
3.0	45	994
3.5	55	988
4.0	65	981
4.5	77	973
5.0	90	964
5.5	102	954
6.0	115	942
6.5	127	929
7.0	140	915
7.5	155	900
8.0	170	884

(6) ACCRY - Fix position accuracy. Both navigational (OMEGA and LORAN) and meteorological (by the ARWO) estimates are given in nautical miles.

(7) EYE SHAPE - Geometrical representation of the eye based on the aircraft radar presentation. The eye shape is reported only if the center is 50 percent or more surrounded by wall cloud.

(8) EYE DIAM/ORIENTATION - Diameter of the eye in nautical miles. When an elliptical eye is present, the lengths of the major and minor axes and the orientation of the major axis are respectively listed. When concentric eye walls are present, each diameter is listed.

c. Radar

(1) RADAR - Specific type of

platform (land, aircraft, or ship) utilized for fix.

(2) ACCRY - Accuracy of fix position (good, fair, or poor) as given in the WMO ground radar weather observation code (FM20-V).

(3) EYE SHAPE - Geometrical representation of the eye given in plain language (circular, elliptical, etc.).

(4) EYE DIAM - Diameter of eye given in kilometers.

(5) RADOB CODE - Taken directly from WMO ground weather radar observation code FM20-V. The first group specifies the vortex parameters, while the second group describes the movement of the vortex center.

(6) RADAR POSITION - Latitude and longitude of tracking station given in tenths of a degree.

(7) SITE - WMO station number of the specific tracking station.

CHAPTER III - SUMMARY OF TROPICAL CYCLONES

1. WESTERN NORTH PACIFIC TROPICAL CYCLONES

During 1984, the western North Pacific experienced the sixth consecutive year of below average tropical cyclone activity. Thirty tropical cyclones occurred in 1984, one less than the annual average. Only three significant tropical cyclones failed to develop beyond the tropical depression (TD) stage and eleven tropical storms (TS) failed to reach typhoon intensity. Of the 16 tropical cyclones that developed to typhoon (TY) intensity, two reached the 130 kt (67 m/s) intensity necessary to be classified as super typhoons (STY). In the western North Pacific, tropical cyclones reaching tropical storm intensity or greater are assigned names in alphabetical order from a list of alternating male/female names (refer to Appendix III). Table 3-1 provides a summary of key statistics for all western North Pacific tropical cyclones. Each tropical cyclone's maximum surface wind (in knots) and minimum sea level pressure (in millibars) were obtained from best estimates based on all available data. The distance traveled (in nautical miles) was calculated from the JTWC official best tracks (see Annex A).

Table 3-2 through 3-5 provide further information on the monthly and yearly distribution of tropical cyclones and statistics on Tropical Cyclone Formation Alerts and Warnings.

TABLE 3-1. WESTERN NORTH PACIFIC

1984 SIGNIFICANT TROPICAL CYCLONES

TROPICAL CYCLONE			PERIOD OF WARNING	CALENDAR DAYS OF WARNING	NUMBER OF WARNINGS ISSUED	MAXIMUM SURFACE WINDS (KT)	ESTIMATED MSLP (MB)	BEST TRACK DISTANCE TRAVELED (NM)
01W	TS	VERNON	09 JUN - 11 JUN	3	9	40	993	556
02W	TS	WYNNE	19 JUN - 26 JUN	8	28	60	980	1609
03W	TY	ALEX	01 JUL - 05 JUL	5	18	75	970	1320
04W	TS	BETTY	06 JUL - 09 JUL	4	12	55	983	1157
05W	TY	CARY	07 JUL - 14 JUL	8	30	90	955	1355
06W	TY	DINAH	24 JUL - 01 AUG	9	35	125	915	2826
07W	TY	ED	25 JUL - 01 AUG	8	28	100	947	1700
08W	TS	FREDA	05 AUG - 08 AUG	4	12	55	982	1894
09W	TD	09W	11 AUG - 15 AUG	5	10	30	996	1328
10W	TS	GERALD	16 AUG - 21 AUG	6	24	55	979	1009
11W	TY	HOLLY	16 AUG - 22 AUG	7	25	75	963	1712
12W	TD	12W	24 AUG - 25 AUG	2	5	20	995	605
13W	TY	IKE	27 AUG - 06 SEP	11	42	125	947	2806
14W	TS	JUNE	28 AUG - 30 AUG	3	11	60	983	738
15W	TY	KELLY	13 SEP - 18 SEP	6	18	75	965	1297
16W	TS	LYNN	24 SEP - 27 SEP	4	14	40	996	553
17W	TS	MAURY	28 SEP - 01 OCT	4	13	60	992	863
18W	TS	NINA	28 SEP - 01 OCT	4	15	55	990	1201
19W	TY	OGDEN	07 OCT - 10 OCT	4	12	70	982	1236
20W	TY	PHYLLIS	11 OCT - 14 OCT	4	13	80	974	972
21W	TS	ROY	11 OCT - 13 OCT	3	9	35	996	735
22W	TS	SUSAN	11 OCT - 12 OCT	2	5	40	992	576
23W	TD	23W	17 OCT - 18 OCT	2	4	25	998	287
24W	TY	THAD	19 OCT - 24 OCT	6	21	120	925	2362
25W	STY	VANESSA	22 OCT - 31 OCT	10	31	155	879	3125
26W	TY	WARREN	23 OCT - 31 OCT	9	31	65	976	1111
27W	TY	AGNES	01 NOV - 08 NOV	8	28	120	925	2666
28W	STY	BILL	08 NOV - 22 NOV	15	52	130	909	2892
29W	TY	CLARA	14 NOV - 21 NOV	8	30	110	938	2709
30W	TY	DOYLE	04 DEC - 11 DEC	8	26	125	935	1960
			1984 TOTALS :	130*	611			

* OVERLAPPING DAYS INCLUDED ONLY ONCE IN SUM.

TABLE 3-2.

1984 SIGNIFICANT TROPICAL CYCLONES

WESTERN NORTH PACIFIC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL	(1959-1984) AVERAGE	CASES
TROPICAL DEPRESSIONS	0	0	0	0	0	0	0	2	0	1	0	0	3	3.8	98
TROPICAL STORMS	0	0	0	0	0	2	1	3	3	2	0	0	11	10.0	259
TYPHOONS	0	0	0	0	0	0	4	2	1	5	3	1	16	17.3	451
ALL TROPICAL CYCLONES	0	0	0	0	0	2	5	7	4	8	3	1	30	31.1	808
1959-1984 AVERAGE	.5	.3	.7	.8	1.3	2.0	4.9	6.3	5.7	4.6	2.7	1.4	31.1		
CASES	13	8	18	22	33	51	127	163	148	119	70	36	808		

FORMATION ALERTS: 30 of 37 Formation Alerts developed into significant tropical cyclones. Tropical Cyclone Formation Alerts were issued for all significant tropical cyclones that developed in 1984.

WARNINGS:

WARNINGS:	Number of warning days:	130
	Number of warning days with two tropical cyclones in region:	46
	Number of warning days with three or more tropical cyclones in region:	4

TABLE 3-3.

FREQUENCY OF TYPHOONS BY MONTH AND YEAR

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
(1945-1958) AVERAGE	.4	.1	.3	.4	.7	1.1	2.0	2.9	3.2	2.4	2.0	.9	16.3
1959	0	0	0	1	0	0	1	5	3	3	2	2	17
1960	0	0	0	1	0	2	2	8	0	4	1	1	19
1961	0	0	1	0	2	1	3	3	5	3	1	1	20
1962	0	0	0	1	2	0	5	7	2	4	3	0	24
1963	0	0	0	1	1	2	3	3	3	4	0	2	19
1964	0	0	0	0	2	2	6	3	5	3	4	1	26
1965	1	0	0	1	2	2	4	[illegible]	5	2	1	0	21
1966	0	0	0	1	2	1	3	6	4	2	0	1	20
1967	0	0	1	1	0	1	3	4	4	3	3	0	20
1968	0	0	0	1	1	1	1	4	3	5	4	0	20
1969	1	0	0	1	0	0	2	3	2	3	1	0	13
1970	0	1	0	0	0	1	0	4	2	3	1	0	12
1971	0	0	0	3	1	2	6	3	5	3	1	0	24
1972	1	0	0	0	1	1	4	4	3	4	2	2	22
1973	0	0	0	0	0	0	4	2	2	4	0	0	12
1974	0	0	0	0	1	2	1	2	3	4	2	0	14
1975	1	0	0	0	0	0	1	3	4	3	2	0	15
1976	1	0	0	1	2	2	2	1	4	1	1	0	15
1977	0	0	0	0	0	0	3	0	2	3	2	1	11
1978	0	0	0	1	0	0	3	2	4	3	2	0	15
1979	1	0	1	1	0	0	2	2	3	2	1	1	14
1980	0	0	0	0	2	0	3	2	5	2	1	0	15
1981	0	0	1	0	0	2	2	2	4	1	2	2	16
1982	0	0	2	0	1	1	2	5	3	3	1	1	19
1983	0	0	0	0	0	0	3	2	1	4	2	0	12
1984	0	0	0	0	0	0	4	2	1	5	3	1	16
(1959-1984) AVERAGE	.2	.04	.2	.6	.8	.9	2.8	3.3	3.2	3.1	1.7	.6	17.3
CASES	6	1	6	15	20	23	73	85	82	81	43	16	451

TABLE 3-4.

FREQUENCY OF TROPICAL STORMS AND TYPHOONS BY MONTH AND YEAR

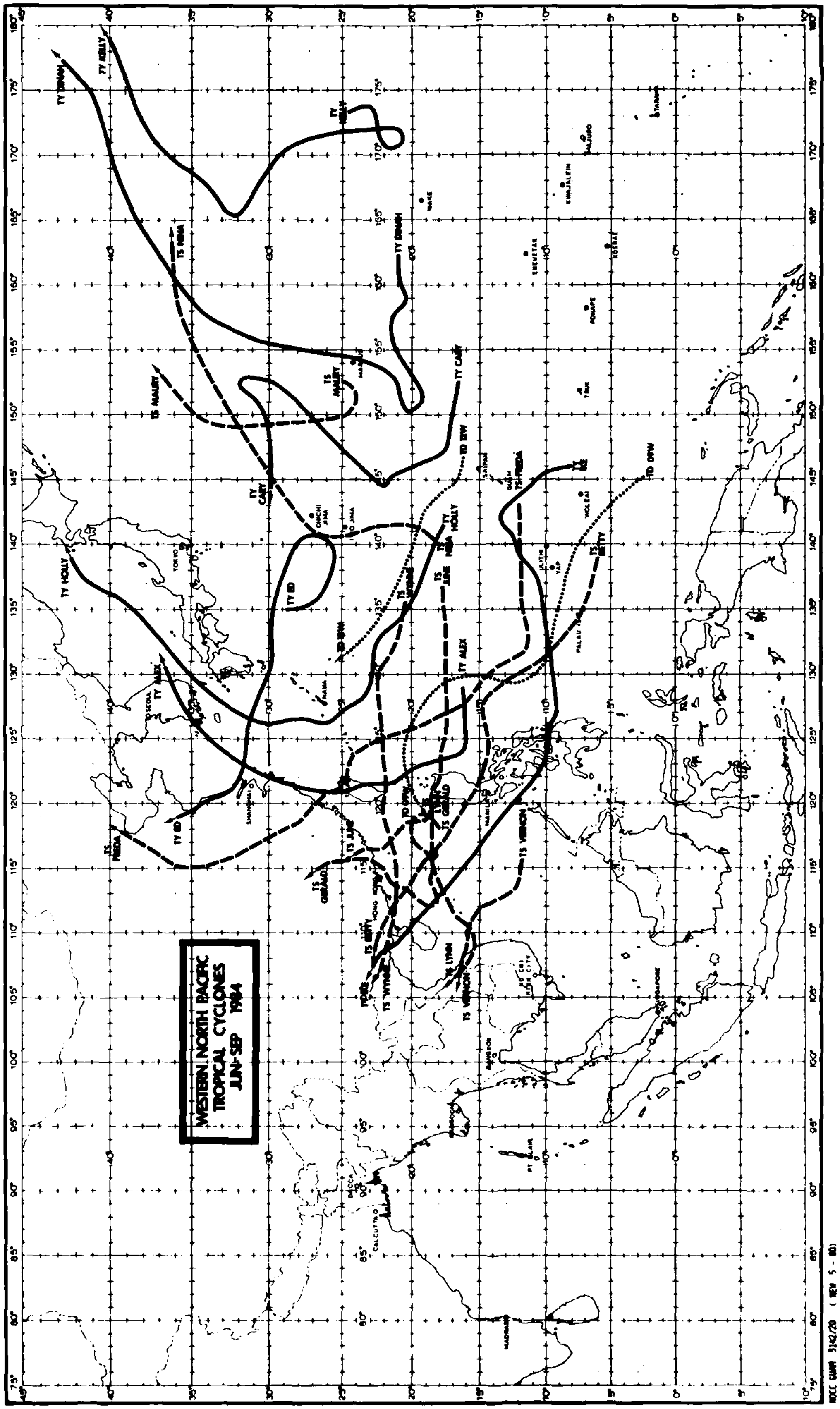
YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
(1945-1958) AVERAGE	.4	.1	.4	.5	.8	1.3	3.0	3.9	4.1	3.3	2.7	1.1	21.6
1959	0	1	1	1	0	0	3	6	6	4	2	2	26
1960	0	0	0	1	1	3	3	10	3	4	1	1	27
1961	1	1	1	1	3	2	5	4	6	5	1	1	31
1962	0	1	0	1	2	0	6	7	3	5	3	2	30
1963	0	0	0	1	1	3	4	3	5	5	0	3	25
1964	0	0	0	0	2	2	7	9	7	6	6	1	40
1965	2	2	1	1	2	3	5	6	7	2	2	1	34
1966	0	0	0	1	2	1	5	8	7	3	2	1	30
1967	1	0	2	1	1	1	6	8	7	4	3	1	35
1968	0	0	0	1	1	1	3	8	3	6	4	0	27
1969	1	0	1	0	0	0	3	4	3	3	2	1	19
1970	0	1	0	0	0	2	2	6	4	5	4	0	24
1971	1	0	1	3	4	2	8	4	6	4	2	0	35
1972	1	0	0	0	1	3	6	5	4	5	2	3	30
1973	0	0	0	0	0	0	7	5	2	4	3	0	21
1974	1	0	1	1	1	4	4	5	5	4	4	2	32
1975	1	0	0	0	0	0	2	4	5	5	3	0	20
1976	1	1	0	2	2	2	4	4	5	1	1	2	25
1977	0	0	1	0	0	1	4	1	5	4	2	1	19
1978	1	0	0	1	0	3	4	7	5	4	3	0	28
1979	1	0	1	1	1	0	4	2	7	3	2	2	24
1980	0	0	0	1	4	1	4	2	6	4	1	1	24
1981	0	0	1	2	0	2	5	7	4	2	3	2	28
1982	0	0	3	0	1	3	4	5	5	3	1	1	26
1983	0	0	0	0	0	1	3	5	2	5	5	2	23
1984	0	0	0	0	0	2	5	5	4	7	3	1	27
(1959-1984) AVERAGE	.5	.3	.5	.8	1.1	1.6	4.5	5.4	4.8	4.1	2.5	1.2	27.3
CASES	12	7	14	21	29	42	116	140	126	107	65	31	710

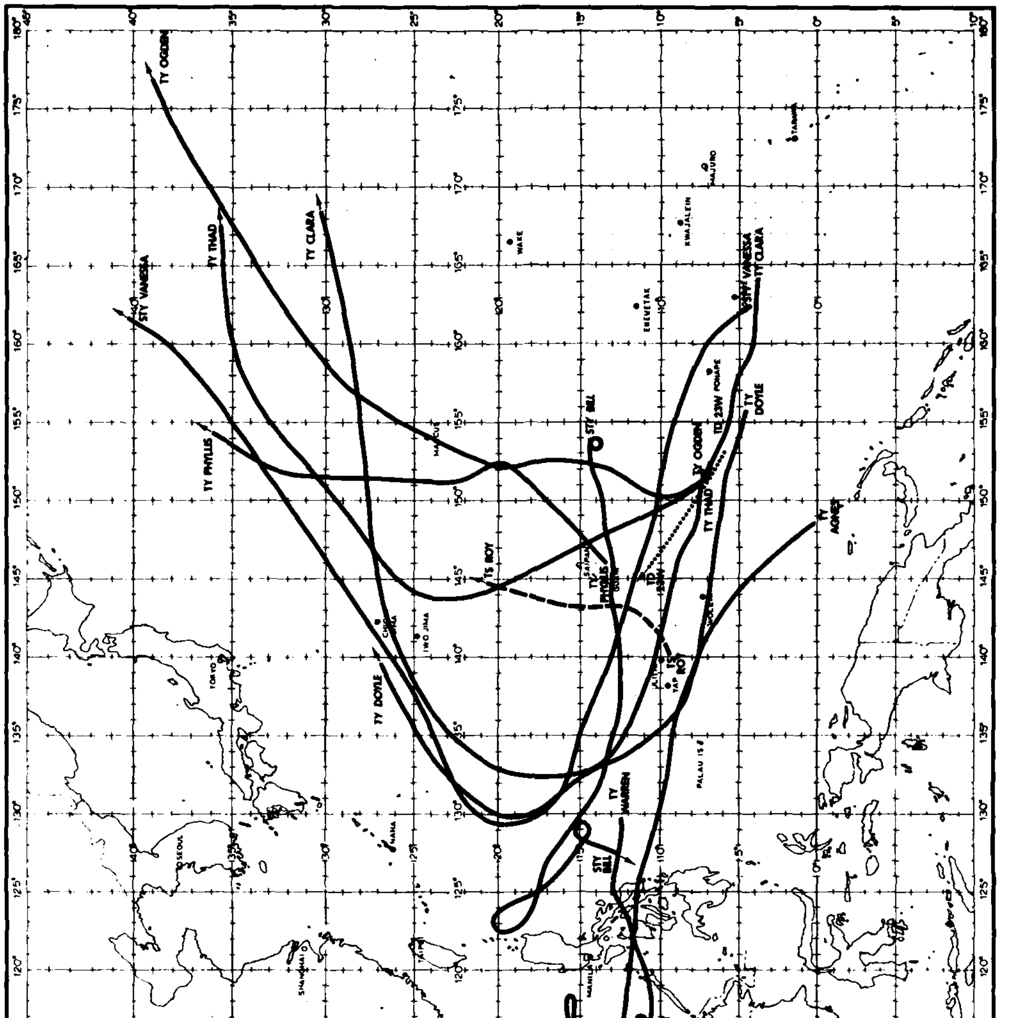
TABLE 3-5.

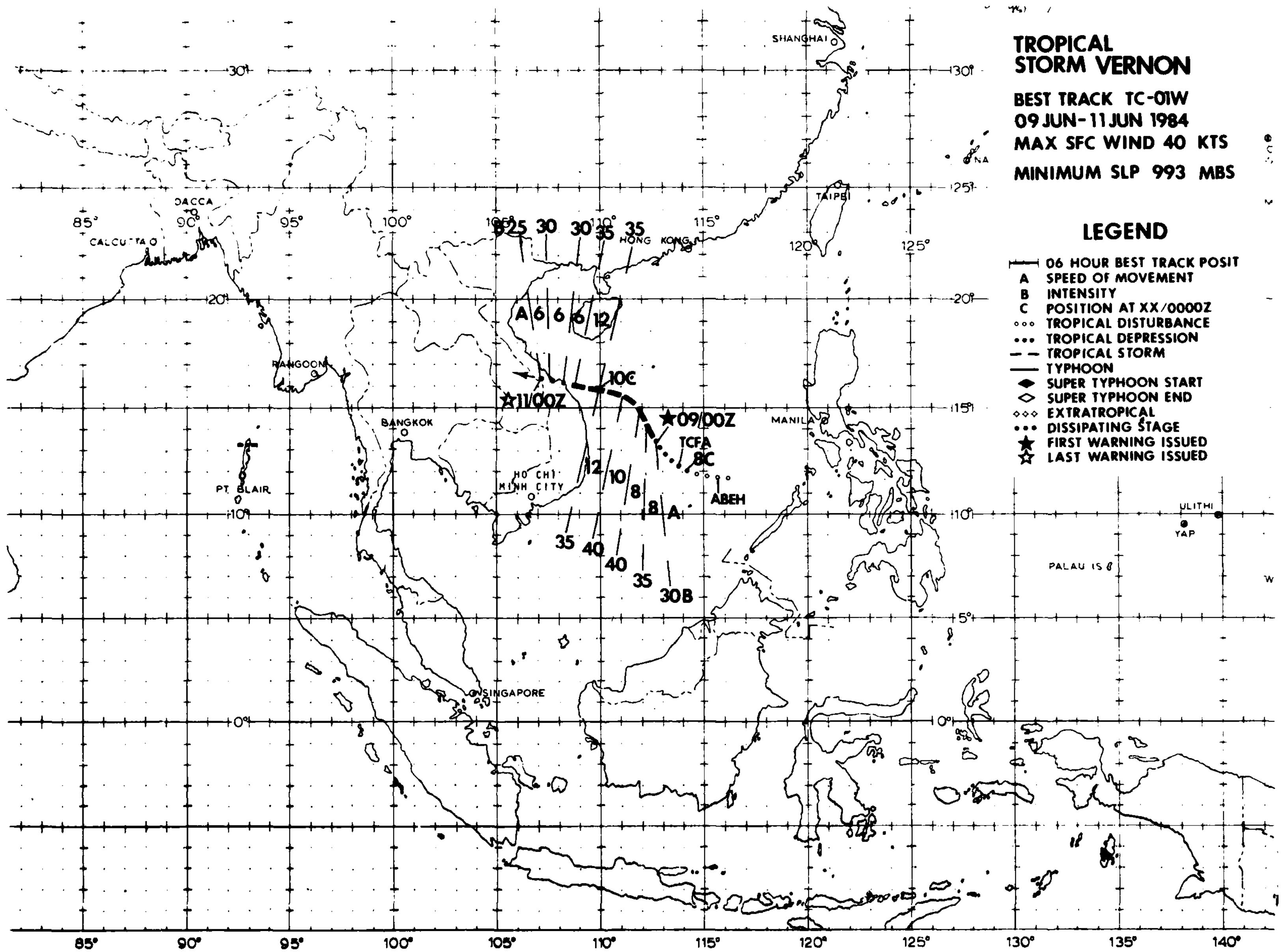
FORMATION ALERT SUMMARY

WESTERN NORTH PACIFIC

YEAR	NUMBER OF ALERT SYSTEMS	ALERT SYSTEMS WHICH BECAME NUMBERED TROPICAL CYCLONES	TOTAL NUMBERED TROPICAL CYCLONES	DEVELOPMENT RATE
1972	41	29	32	71%
1973	26	22	23	85%
1974	35	30	36	86%
1975	34	25	25	74%
1976	34	25	25	74%
1977	26	20	21	77%
1978	32	27	32	84%
1979	27	23	28	85%
1980	37	28	28	76%
1981	29	28	29	97%
1982	36	26	28	72%
1983	31	25	25	81%
1984	37	30	30	81%
(1972-1984) AVERAGE	32.7	26.0	27.8	80%
CASES	425	338	362	


WESTERN NORTH PACIFIC
TROPICAL CYCLONES
JUN-SEP 1984
TY KELLY
TY HOLLY
TY IKE
TD 09W
TY ALEX
TS NINA
TS MAURY
TY CARY
TY ED
TS FREDA
TS VERNON
TS LYNN
TS JUNE
TS GERALD
TS BETTY
TY DINAH


WESTERN NORTH PACIFIC
TROPICAL CYCLONES
OCT-DEC 1984
TY OGDEN
STY VANESSA
TY THAD
TY CLARA
TY PHYLLIS
STY BILL
TS ROY
TY DOYLE
TY AGNES
TS SUSAN
TY WARREN
TD 23W
NOCC GUAM 3142/20 (REV 5-80)


TROPICAL
STORM VERNON
BEST TRACK TC-01W
09 JUN-11 JUN 1984
MAX SFC WIND 40 KTS
MINIMUM SLP 993 MBS
LEGEND
06 HOUR BEST TRACK POSIT
A SPEED OF MOVEMENT
B INTENSITY
C POSITION AT XX/0000Z
TROPICAL DISTURBANCE
TROPICAL DEPRESSION
TROPICAL STORM
TYPHOON
SUPER TYPHOON START
SUPER TYPHOON END
EXTRATROPICAL
DISSIPATING STAGE
FIRST WARNING ISSUED
LAST WARNING ISSUED
SHANGHAI
TAIPEI
HONG KONG
MANILA
DACCA
CALCUTTA
RANGOON
BANGKOK
HO CHI MINH CITY
PT BLAIR
SINGAPORE
ULITHI
YAP
PALAU IS
09/00Z
11/00Z
TCFA
10C
8C
ABEH
30B
85°
90°
95°
100°
105°
110°
115°
120°
125°
130°
135°
140°
30°
25°
20°
15°
10°
5°
0°

TROPICAL STORM VERNON (01W)

The formation of Tropical Storm Vernon marked the start of the western Pacific tropical cyclone season. This is the second year in a row that the first tropical cyclone of the season did not develop until June, and the first time since JTWC was established that two consecutive seasons have started so late in the year.

Tropical Storm Vernon was very similar to its 1983 season opening counterpart, Tropical Storm Sarah, in that it formed in the South China Sea during June, developed into a weak Tropical Storm, and made landfall in central Vietnam.

The disturbance which was to develop into Tropical Storm Vernon was first detected early on 7 June as an area of poorly organized convection on the eastern end of the monsoon trough in the central South China Sea. The disturbance drifted slowly to the northwest and consolidated during the next 24 hours. At 0411Z on the 8th, a TCFA was issued based on improved organization of the convection and synoptic data which indicated the disturbance had a closed surface circulation with winds of 15 to 25 kt (8 to 13 m/s). Vernon continued moving to the northwest at 5 kt (9 km/hr) and at 0000Z on the 9th the first warning was issued based on numerous 25 to 30 kt (13 to 15 m/s) ship reports. The MSLP at this time was near 999 mb.

Over the next 18 hours Vernon's forward speed doubled to 10 kt (19 km/hr) as the storm intensified, attaining tropical storm strength between 0000Z and 0600Z on the 9th and reaching a maximum intensity of 40 kt (21 m/s) approximately 6 to 9 hours later (Figure 3-01-1).

Vietnamese authorities reported that Vernon caused flooding of rice, sweet potato, and sesame crops in the Quang Nam-Danang province. No loss of life or other significant property damage was reported.

After reaching maximum intensity, Vernon moved in a more westerly direction at 12 kt (22 km/hr), and began to weaken as the storm entered a strong shearing environment. Vernon continued toward the coast of Vietnam, making landfall just north of Da Nang (WMO 48855) at approximately 101200Z. By this time most of Vernon's convection was sheared to the west of the low-level circulation. Vernon quickly dissipated over land.

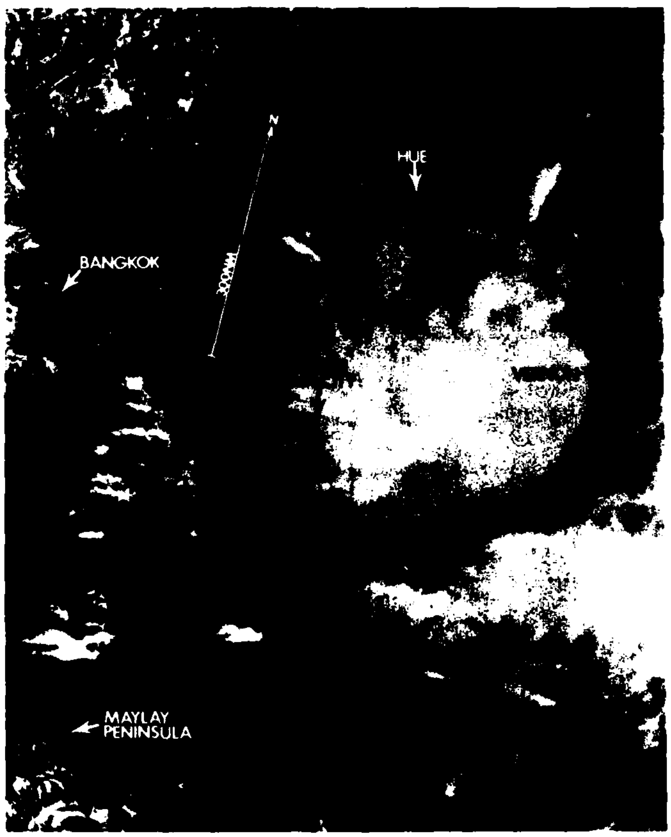


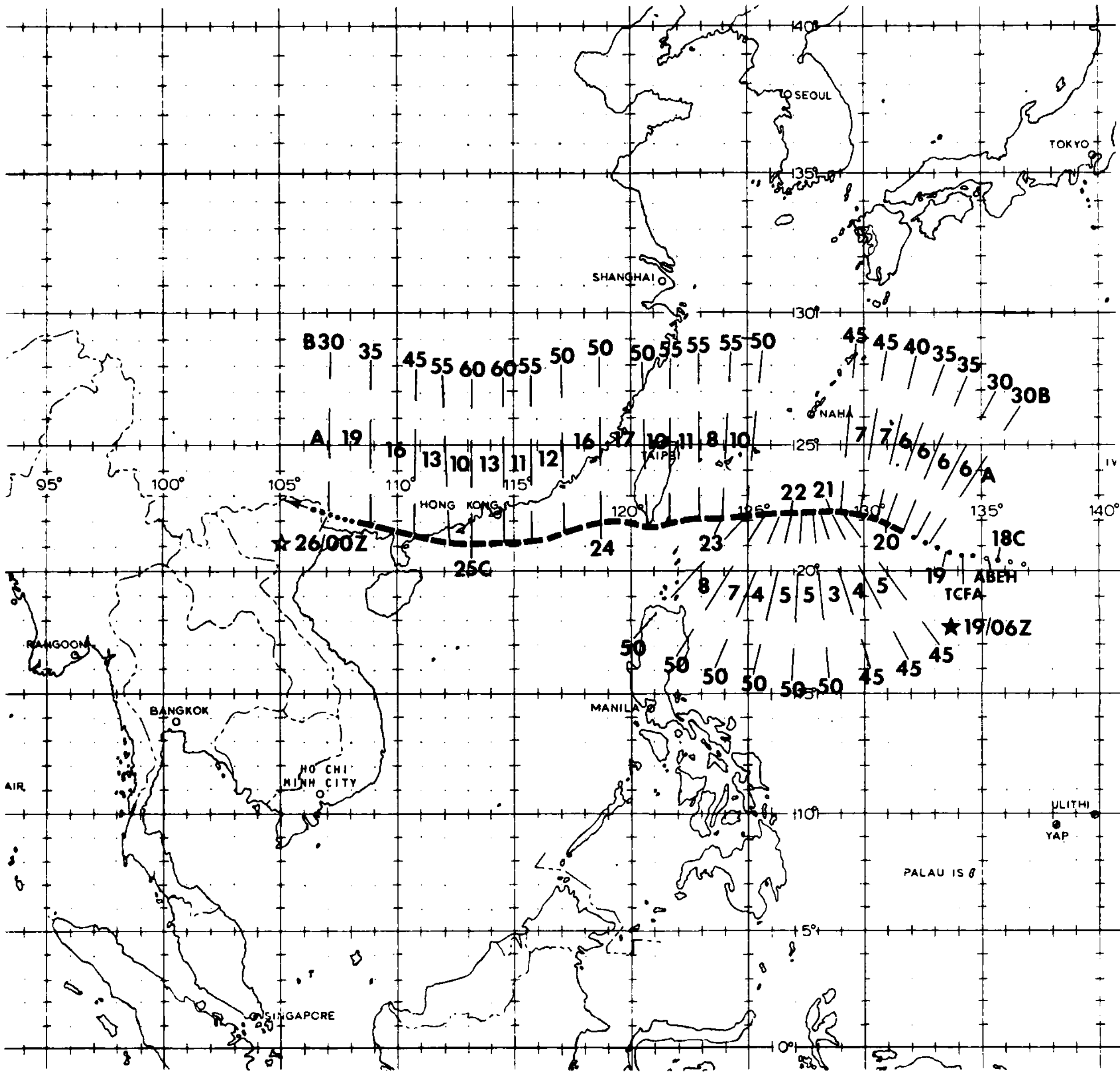
Figure 3-01-1. Tropical Storm Vernon with exposed low-level circulation as it attains tropical storm intensity (090316Z June DMSP visual imagery).

TROPICAL STORM WYNNE

BEST TRACK TC-02W
19 JUN - 26 JUN 1984
MAX SFC WIND 60 KTS
MINIMUM SLP 980 MBS

LEGEND

- 06 HOUR BEST TRACK POSIT
- A SPEED OF MOVEMENT
- B INTENSITY
- C POSITION AT XX/0000Z
- ◦◦◦ TROPICAL DISTURBANCE
- ••• TROPICAL DEPRESSION
- — — TROPICAL STORM
- —— TYPHOON
- ◆ SUPER TYPHOON START
- ◇ SUPER TYPHOON END
- ◇◇◇ EXTRATROPICAL
- ••• DISSIPATING STAGE
- ★ FIRST WARNING ISSUED
- ☆ LAST WARNING ISSUED



TROPICAL STORM WYNNE (02W)

After Tropical Storm Vernon (01W) dissipated over Vietnam, the southwest monsoon was slow to re-establish itself. Surface ridging from an anticyclone over the northern Philippine Sea and later from a 1030 mb high east of Japan kept easterlies in the Philippine Sea and across Luzon until the 14th of June. By then the ridge east of Japan had moved far enough east to allow a weak southwest monsoon to become established from the South China Sea eastward into the Philippine Sea. This set the stage for the development of Tropical Storm Wynne.

The disturbance which developed into the second storm of the season was first detected late on 16 June in the northern Philippine Sea as an area of concentrated convection embedded in the southwest monsoon. By 17 June a broad, weak surface circulation had developed near 20N 137E with an MSLP of 1005 mb and 10 to 20 kt (5 to 10 m/s) surface winds. The organization of the convection continued to improve, prompting the issuance of a TCFA at 1600Z on the 18th. At that time, synoptic data indicated a weak upper-level anticyclone had developed aloft providing good outflow to the south and west. Late on the 18th, the first aircraft reconnaissance flight into the disturbance found a 6 nm (11 km) wide surface center with an MSLP of 998 mb and maximum surface winds of 20 kt (10 m/s). At 190933Z the first warning on Wynne, valid at 190600Z, was issued.

Wynne maintained a predominantly westward track throughout its life. The storm was steered by the westward flow along the southern side of the mid to low-level subtropical ridge. This ridge was apparently too narrow to be resolved by JTWC's primary forecast aid, the One-Way Interactive Tropical Cyclone Model (OTCM). As a result, OTCM repeatedly predicted a northward track for the storm. By the second warning, JTWC forecasters had noticed this apparent problem with OTCM and began forecasting a more westward track than OTCM indicated.

On 19 June a mid-latitude trough passed to the north of Wynne causing Wynne to turn briefly to the northwest. However, the trough did not weaken the subtropical ridge enough to allow for recurvature. After the trough passed on the 20th, Wynne once again resumed its westward heading which it maintained until landfall.

Despite the five days Wynne remained in the Philippine Sea east of Taiwan, it did not intensify beyond 55 kt (28 m/s). The weak upper-level anticyclone which developed over Wynne on the 18th remained very small, being overshadowed by a much larger upper-level anticyclone to the north over mainland China. Therefore, Wynne remained under a strong shearing environment from the north and northeast throughout its life, which hindered intensification.

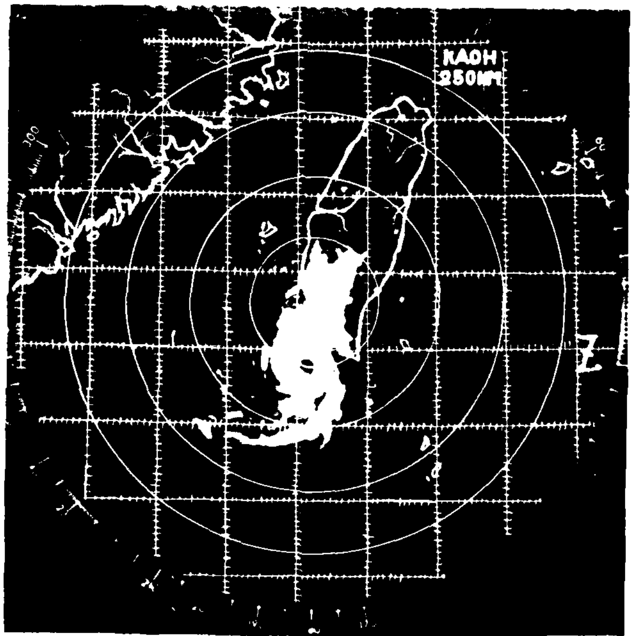


Figure 3-02-1. Tropical Storm Wynne as it passed south of Taiwan as seen by radar from Kaohsuing (WMO 46744) at 231900Z June (Photograph courtesy of Central Weather Bureau, Taipei, Taiwan).

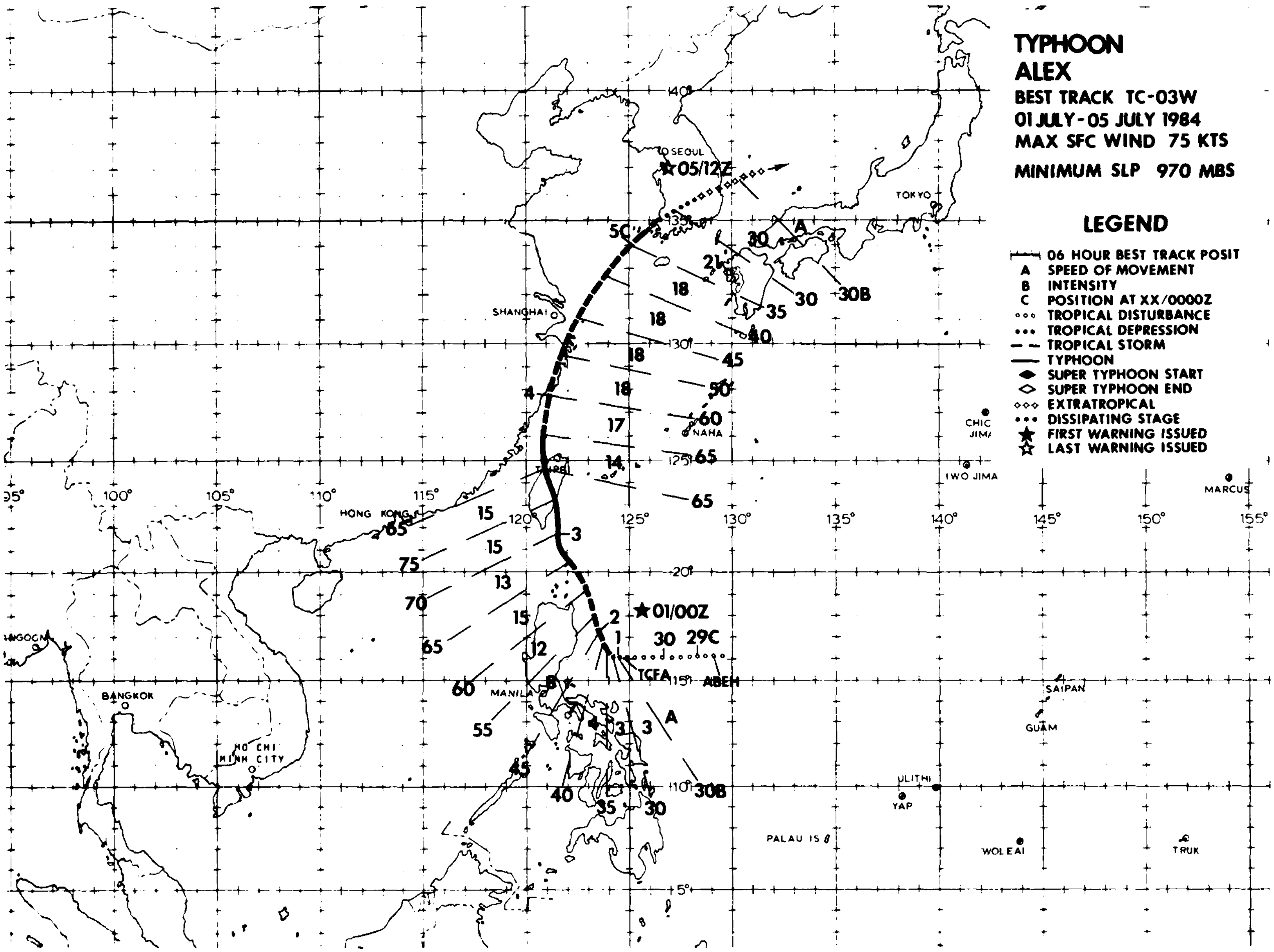
Figure 3-02-2. Wynne as a 50 kt (26 m/s) tropical storm entering the south China Sea (240136Z June DMSP visual imagery).

Wynne strengthened to 55 kt (28 m/s) just prior to passing the southern coast of Taiwan. The sea level pressure of Lanyu (WMO 46762), located just east of the southern tip of Taiwan, dropped 14 mb in the 12 hours preceeding the storm's arrival, reaching 984 mb with Wynne's passage. As Wynne passed the southern tip of Taiwan (Figure 3-02-1), its low-level circulation was disrupted causing Wynne to weaken slightly as it entered the South China Sea (Figure 3-02-2).

Wynne passed 70 nm (130 km) south of Hong Kong (WMO 45005) about 24 hours after passing the southern tip of Taiwan. By this time Wynne had intensified to its peak intensity of 60 kt (31 m/s). This was confirmed by the USS Mauna Kea (AE22) which inadvertently passed very close to Wynne's center and reported "maximum winds to 60 kt, gusts to 70 kt." Fortunately, no damage or personnel injuries were reported aboard the Mauna Kea. Further north, Hong Kong reported gusts to 60 kt (31 m/s) with the passage of Wynne.

As Wynne traversed the Philippine Sea and the northern Luzon Straits, the southwest monsoon was enhanced producing 20 to 30 kt (10 to 15 m/s) winds, high seas and heavy rainfall. In Luzon, at least 20 families were reported left homeless and 10,000 hectares of riceland destroyed by floods. North of Luzon, three fishermen drowned when their boats capsized in heavy seas.

Tropical Storm Wynne made landfall at approximately 1200Z on the 25th on the coast of the People's Republic of China near the Luichow Peninsula, and weakened rapidly as it moved inland. The final warning on Wynne was issued at 0000Z on the 26th.


TYPHOON
ALEX
BEST TRACK TC-03W
01 JULY-05 JULY 1984
MAX SFC WIND 75 KTS
MINIMUM SLP 970 MBS
LEGEND
06 HOUR BEST TRACK POSIT
A SPEED OF MOVEMENT
B INTENSITY
C POSITION AT XX/0000Z
TROPICAL DISTURBANCE
TROPICAL DEPRESSION
TROPICAL STORM
TYPHOON
SUPER TYPHOON START
SUPER TYPHOON END
EXTRATROPICAL
DISSIPATING STAGE
FIRST WARNING ISSUED
LAST WARNING ISSUED
05/12Z
01/00Z
TCFA
ABEH
SEOUL
TOKYO
SHANGHAI
NAHA
HONG KONG
MANILA
BANGKOK
HO CHI MINH CITY
CHIC JIMA
IWO JIMA
MARCUS
SAIPAN
GUAM
ULITHI
YAP
PALAU IS
WOLEAI
TRUK
95°
100°
105°
110°
115°
120°
125°
130°
135°
140°
145°
150°
155°

TYPHOON ALEX (03W)

Typhoon Alex was the first typhoon of the 1984 western Pacific season. It was also the season's first recurver. The satellite fixes during the formative stages of Alex were somewhat misleading and contributed to rather large forecast errors on the first day in warning status. After reaching typhoon intensity and crossing Taiwan, the last phase of Alex's life was characterized by a complex transition into an extratropical low.

The seedlings of Alex first caught the attention of the JTWC forecasters on the 28th of June. Based on several ship reports showing that a circulation center had developed in the Philippine Sea, the Significant Tropical Weather Advisory (ABEH PGTW) was reissued at 281415Z stating that a 10 to 15 kt (5 to 8 m/s) surface circulation had developed near 16N 129E, within a disorganized area of convection in the monsoon trough (point A on Figures 3-03-1 and 3-03-2). This area was identified as one with a "poor" potential for development (meaning the disturbance was not expected to require a TCFA during the advisory period). For the next day-and-a-half the disturbance persisted with no signs of development. At 2301Z on the 29th, visual satellite pictures indicated that a partially exposed low-level circulation had developed on the northern edge of the disturbance (point B on Figures 3-03-1 and 3-03-2). Consequently an aircraft investigation of the area was requested for the following day.

Upon arrival at the invest point, the aircraft radioed back to the JTWC forecaster that a well-defined circulation center was present and that a vortex fix would be forthcoming. Now things happened quickly. The forecaster first notified his customers on Luzon that a tropical depression was developing just to the east of them and they could experience 30 kt (15 m/s) winds within 18 hours. At 2300Z on the 30th a TCFA was issued. Shortly thereafter, at 2338Z, the vortex fix was radioed to JTWC containing details on the closed surface circulation. The first warning on Alex, valid at 0000Z on 1 July quickly followed.

Unfortunately, the first four warnings forecast Alex to move to the west. Satellite fixes starting late on the 29th and continuing through 1800Z on the 1st indicated that the depression was moving west-southwest. Limited radar fixes indicated that the system was nearly stationary. However, when the daylight satellite pictures became available late on 1 July, it was obvious that the system had in reality moved north-northwest (along track CD in Figure 3-03-2) and was now a tropical storm. Thus it was not until warning number five that the westward track was abandoned and not until warning number seven that the recurvature scenario was fully developed.

The rationale behind the forecast track on warning number one now becomes instructive: When the system was first detected "on the doorstep" of Luzon, there

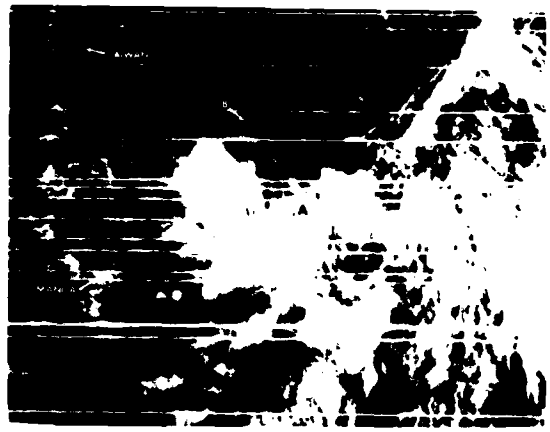


Figure 3-03-1. Initially the exposed low-level circulation center at point B was thought to be the origin of Typhoon Alex. However, post-analysis indicates the actual point of origin was probably near point A (292301Z June NOAA visual imagery).

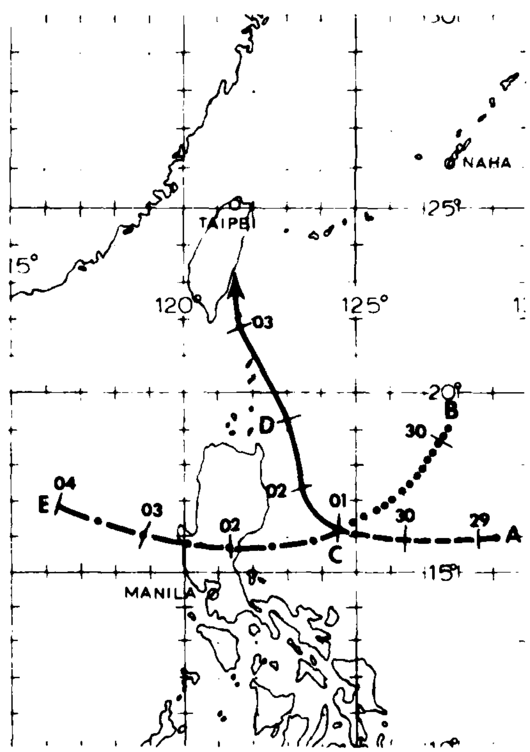


Figure 3-03-2. Point A is believed to be the actual point of origin of Typhoon Alex; Point B is the position of the partially exposed low-level circulation center, initially thought to be the origin of Alex; Point C is the location of the center found by the first aircraft invest; Point D is the best track through 021200Z, and Point E is the 72 hour forecast from warning number one.

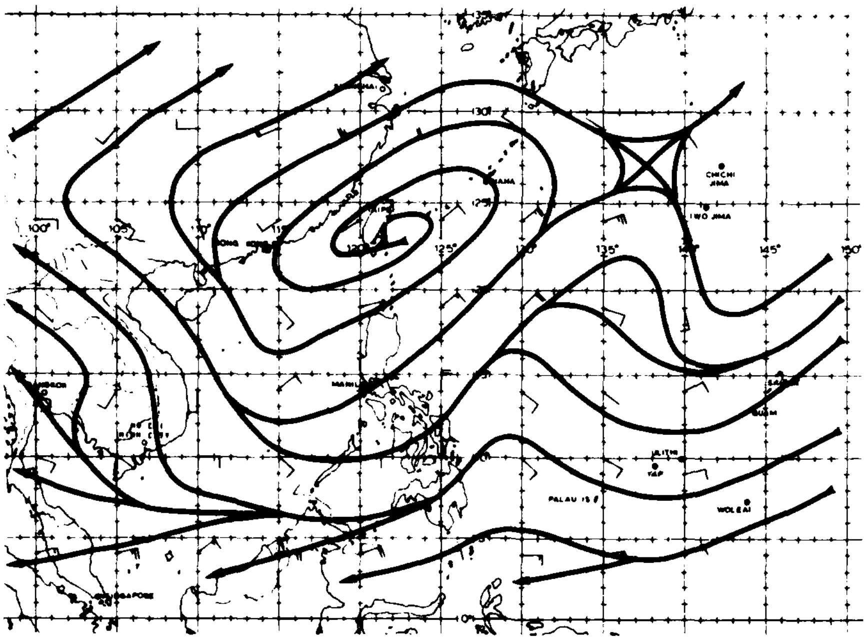


Figure 3-03-3. Mid-tropospheric flow prevailing during the formulation of the first warning forecast reasoning (Streamline analysis of the FNOC 400 mb NVA wind field valid at 301200Z June).

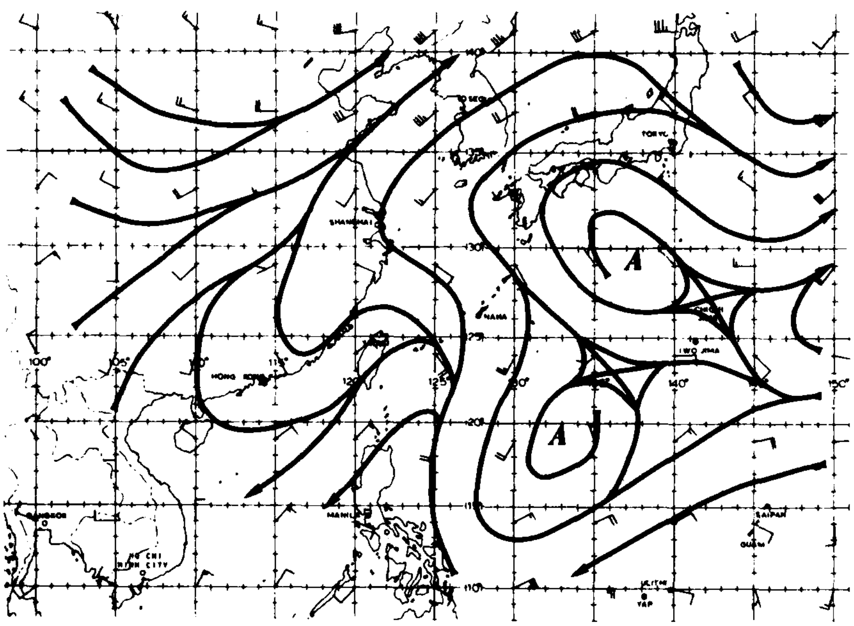


Figure 3-03-4. The mid-tropospheric synoptic situation prevailing during most of the life of Typhoon Alex. Note the anticyclone which has moved east to the south of Japan and the trough over central China which is also moving eastward (Streamline analysis of the FNOC NOGAPS 500 mb wind field valid at 021200Z July).

was an urgency to let the people there know that the potential existed for a tropical cyclone to affect them almost immediately. Therefore it was deemed necessary to devise the forecast track before all of the JTWC forecast aids could be obtained. Available to the forecaster were the past fixes which lead to best track BC on Figure 3-03-2 and a synoptic situation characterized by a mid-tropospheric ridge north of the storm as illustrated in Figure 3-03-3. Given the present and past position of the storm and the northeasterly flow across Luzon, a westward forecast with recurvature beyond the 72 hour point seemed logical. This scenario was briefed to all concerned. When the forecast aids did arrive, they generally agreed with this reasoning. One of the aids which did not agree was the One-Way Interactive Cyclone Model (OTCM), JTWC's primary forecast aid, which forecast Alex to move to the north-northwest to near point D in Figure 3-03-2 in twenty-four hours. The OTCM forecast was discounted for three reasons. First, it was perpendicular to the mid-tropospheric flow and headed toward the center of the ridge near Taiwan. Second, the track BCD seemed highly improbable. Finally, OTCM had consistently and erroneously forecast a westward moving storm (Tropical Storm Wynne (02W)) to go to the north only a week earlier in the same general area.

As it turned out, the OTCM forecast was excellent. Figure 3-03-4 reflects the new synoptic situation. The anticyclone that had been over Taiwan did not persist as originally anticipated but weakened and moved to the east. This movement allowed Alex to accelerate to the north-northwest towards Taiwan. The OTCM had correctly forecast this to occur. With the post-analysis knowledge that Alex did not transit the Philippines, but instead went north-northwest, Figure 3-03-2 should be examined for an explanation of the true origin of Alex. The track BCD seems highly improbable There is currently no explanation for a path from B to C at a speed of nearly 10 kt (19 km/hr), a slow down to 3 kt (6 km/hr) at C followed by a sudden 120 degree turn to the right and an acceleration to 12 kt (22 km/hr) by point D. A much more likely path would be genesis near point A, as was indicated by synoptic data back on 28 June, westward movement at about 5 kt (9 km/hr) to C and then a more gradual turn to the right with acceleration to D. Consequently it is now thought that the low-level circulation center found by satellite imagery at point B on the 29th of June was a "red-herring"; nothing more than an eddy in the monsoon trough.

Once the northward movement of Alex was well established, the forecasts were relatively accurate (although the speeds were somewhat slow). The only question was whether Alex would track up the east coast of Taiwan, cross the middle of the East China Sea and transit through the Korean Strait, or transfer across Taiwan, move along the coast of mainland China and cross South Korea. By warning number 11 this question was correctly resolved as the last eight warnings had excellent track forecasts. Alex continued to intensify reaching a maximum intensity of 75 kt (39 m/s) just prior to crossing Taiwan (Figures 3-03-5 and 3-03-6). During the middle and last phases of Alex's life, the southwesterlies in front of a trough that laid over central Korea provided the steering mechanism. This trough with its associated surface front was the same trough observed over northern China in Figure 3-03-4 several days earlier. Starting on 5 July Alex underwent a complex extratropical transition with this front. The final warning was issued at 051200Z as Alex became indistinguishable from the frontal system over the Sea of Japan.

In summary, Typhoon Alex can be identified as a typical, well-behaved recurver that transitioned into an extratropical system. The first four warnings were marred by erroneous rejection of OTCM, and by acceptance of early fixes from a feature that was probably not part of the genesis mechanism.

Figure 3-03-5. Typhoon Alex just prior to attaining maximum intensity (022329Z July NOAA visual imagery).

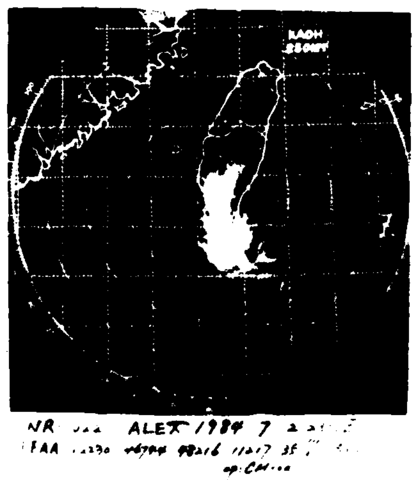
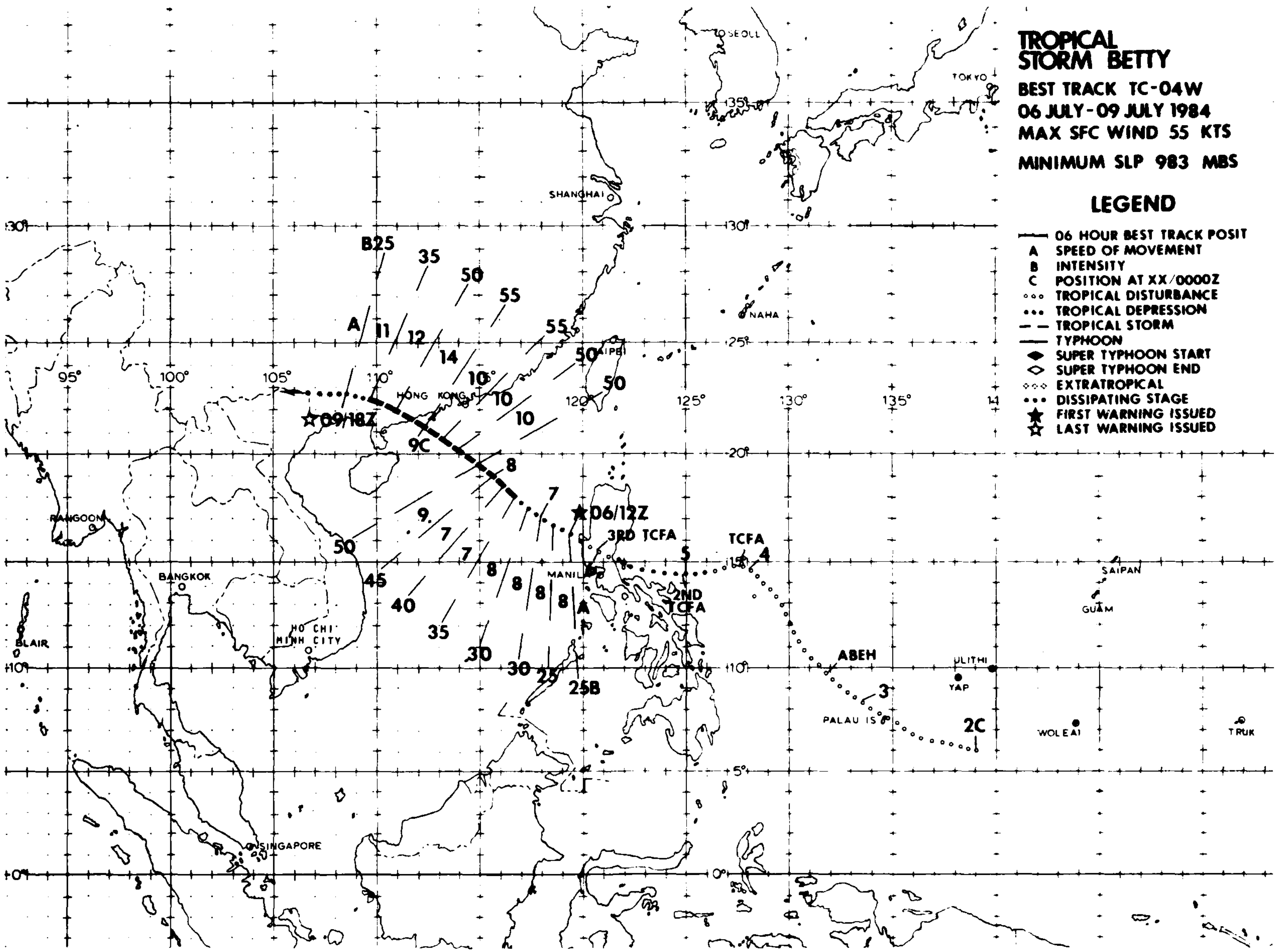


Figure 3-03-6. Typhoon Alex just prior to attaining maximum intensity as seen by radar from Kaohsuing (WMO 46744) at 022300Z July (Photograph courtesy of Central Weather Bureau, Taipei, Taiwan).


TROPICAL STORM BETTY
BEST TRACK TC-04W
06 JULY-09 JULY 1984
MAX SFC WIND 55 KTS
MINIMUM SLP 983 MBS
LEGEND
06 HOUR BEST TRACK POSIT
A SPEED OF MOVEMENT
B INTENSITY
C POSITION AT XX/0000Z
TROPICAL DISTURBANCE
TROPICAL DEPRESSION
TROPICAL STORM
TYPHOON
SUPER TYPHOON START
SUPER TYPHOON END
EXTRATROPICAL
DISSIPATING STAGE
FIRST WARNING ISSUED
LAST WARNING ISSUED
SEOUL
TOKYO
SHANGHAI
NAHA
TAIPEI
HONG KONG
MANILA
BANGKOK
HO CHI MINH CITY
RANGOON
BLAIR
SINGAPORE
SAIPAN
GUAM
ULITHI
YAP
PALAU IS
WOLEAI
TRUK
06/12Z
09/18Z
3RD TCFA
2ND TCFA
TCFA
ABEH
B25
25B
2C
9C

TROPICAL STORM BETTY (04W)

Tropical Storm Betty originated in the eastern extension of the monsoon trough early in July but took several days to develop into a significant tropical cyclone. Once developed, Betty moved steadily to the northwest through the South China Sea eventually making landfall and dissipating over southern China.

At 0000Z on the 2nd, a disturbance which later developed into Tropical Storm Betty was located approximately 550 nm (1019 km) southwest of Guam. Synoptic data showed the disturbance to be a broad, weak surface circulation with winds of 10 to 15 kt (5 to 8 m/s). Concurrent satellite imagery showed the disturbance as an area of poorly organized convection. Strong surface ridging was present between the disturbance and the developing Tropical Storm Alex (03W) to the north which was then located off the east coast of Luzon. Above this surface ridging a TUTT was providing good upper-level outflow to the north of the disturbance enhancing the convective activity.

When the disturbance was mentioned on the 030600Z Significant Tropical Weather Advisory (ABEH PGTW), it had moved northwest behind now Typhoon Alex (03W) which was located east of Taiwan and moving rapidly northward. With the TUTT providing good upper-level outflow over the disturbance, the convection exhibited a marked increase in organization and intensity over 24 hours earlier.

By 0200Z on the 4th, the disturbance had moved to near 15N 128E and was becoming more organized. At this time the first TCFA was issued on the system. Figure 3-04-1 shows the disturbance at the time the TCFA was issued. Note the banding in the convection and anticyclonic upper-level outflow. Synoptic data indicated that only a broad 10 to 15 kt (5 to 8 m/s) surface circulation was present. Strong ridging still persisted north of the disturbance. This ridging was instrumental in preventing Betty from following a path similar to that of Typhoon Alex (03W).

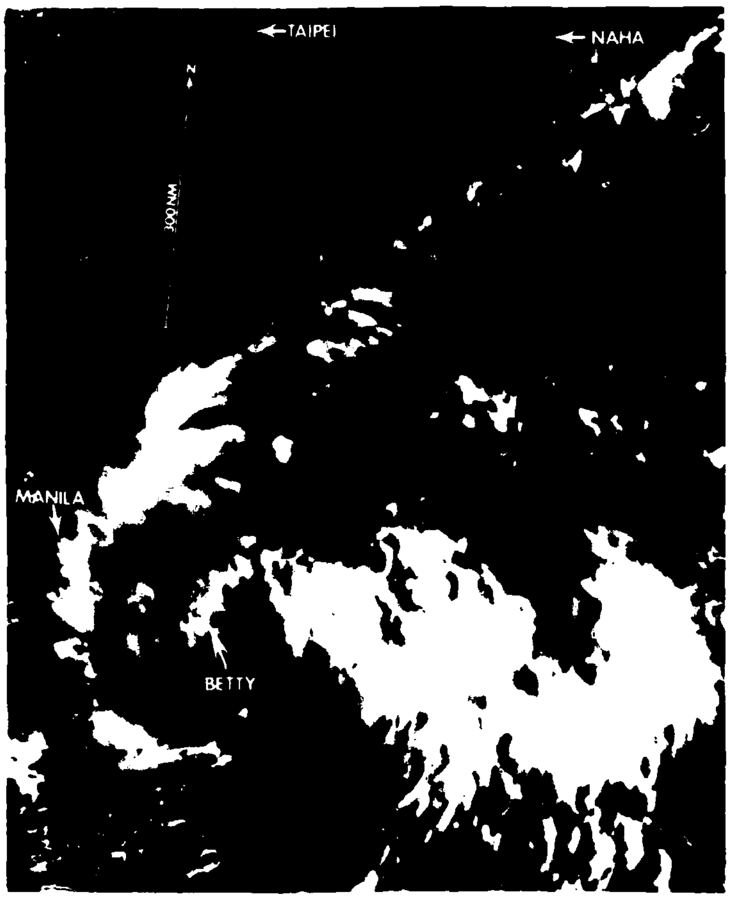


Figure 3-04-1 Tropical storm Betty at the time the first TCFA was issued (040116Z July DMSP visual imagery.

Aircraft reconnaissance flights on 3 and 4 July at the 1500 ft (457 m) level were unable to close-off a circulation center, finding instead a broad surface trough. The TCFA was reissued at 050200Z July since the possibility existed that the system would remain east of Luzon and develop. Aircraft reconnaissance during the afternoon of the 5th indicated that the system had intensified slightly into a weak tropical depression with an MSLP of 1002 mb and maximum surface winds of 25 kt (13 m/s). However, no further development occurred as the system moved west and approached the Philippines.

By the 6th, the depression had weakened as it transited Luzon. At this time the third and final TCFA was issued since it was considered likely that a significant tropical cyclone would finally develop once the disturbance moved out over the South China Sea.

At 1200Z on the 6th, synoptic data indicated that the disturbance had moved offshore west of Luzon and was developing. With surface reports of 20 to 25 kt (10 to 13 m/s) and further intensification very likely, the first warning was issued. Visual satellite imagery late on the 6th (Figure 3-04-2) showed Betty, then a depression, with a large, mostly clear area at its center. An exposed low-level circulation is evident as indicated by the spiraling low-level cumulus clouds. Convective activity is heaviest in the southern semicircle surrounding the mostly convection-free center. Aircraft reconnaissance at about the same time reported a large light and variable center 50 to 60 nm (93 to 111 km) in diameter associated with the depression. Surface winds of 25 to 30 kt (13 to 15 m/s) were observed southeast of the center where the depression's flow was enhanced by the southwest monsoon.

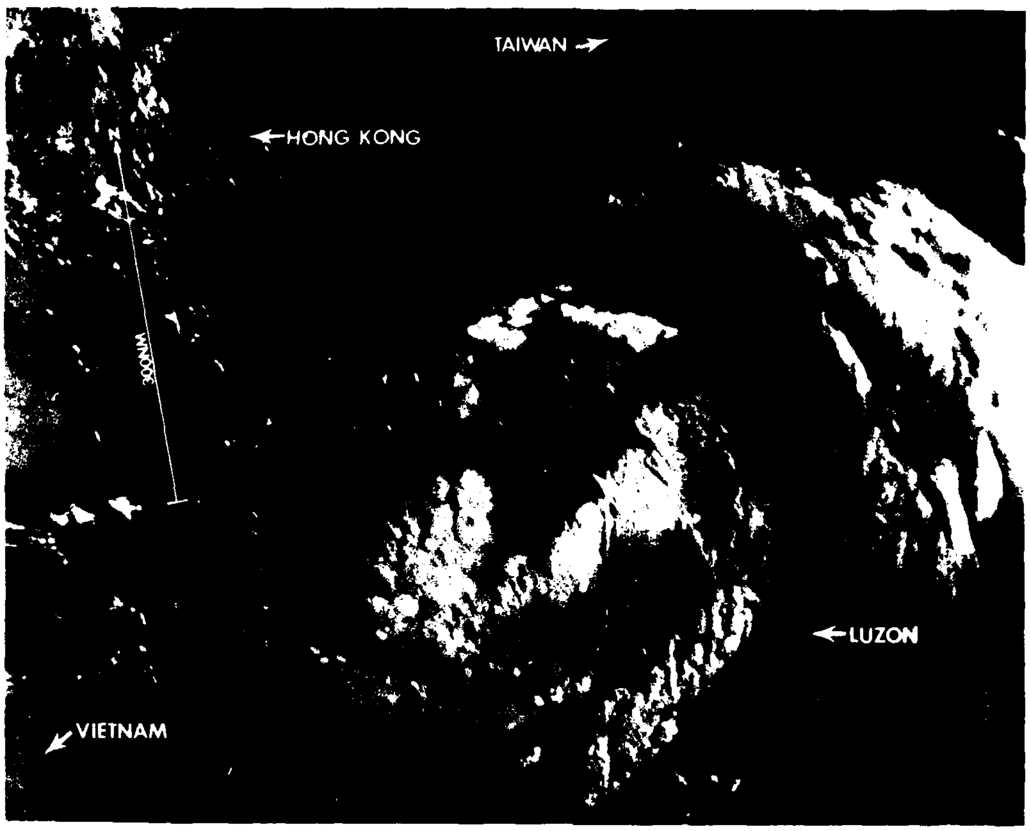


Figure 3-04-2. Tropical Storm Betty as a tropical depression after having crossed the Philippines. Note the exposed low-level circulation center as indicated by spiralling cumulus inside a large convection-free central area (062333Z July NOAA visual imagery).

Betty was upgraded to a tropical storm at 1200Z on the 7th based upon receipt of 35 kt ship reports and satellite imagery showing improved convective organization. Aircraft reconnaissance at 080034Z indicated that Tropical Storm Betty had intensified further with maximum surface winds of 50 kt (26 m/s) being reported in a small area in the east semicircle.

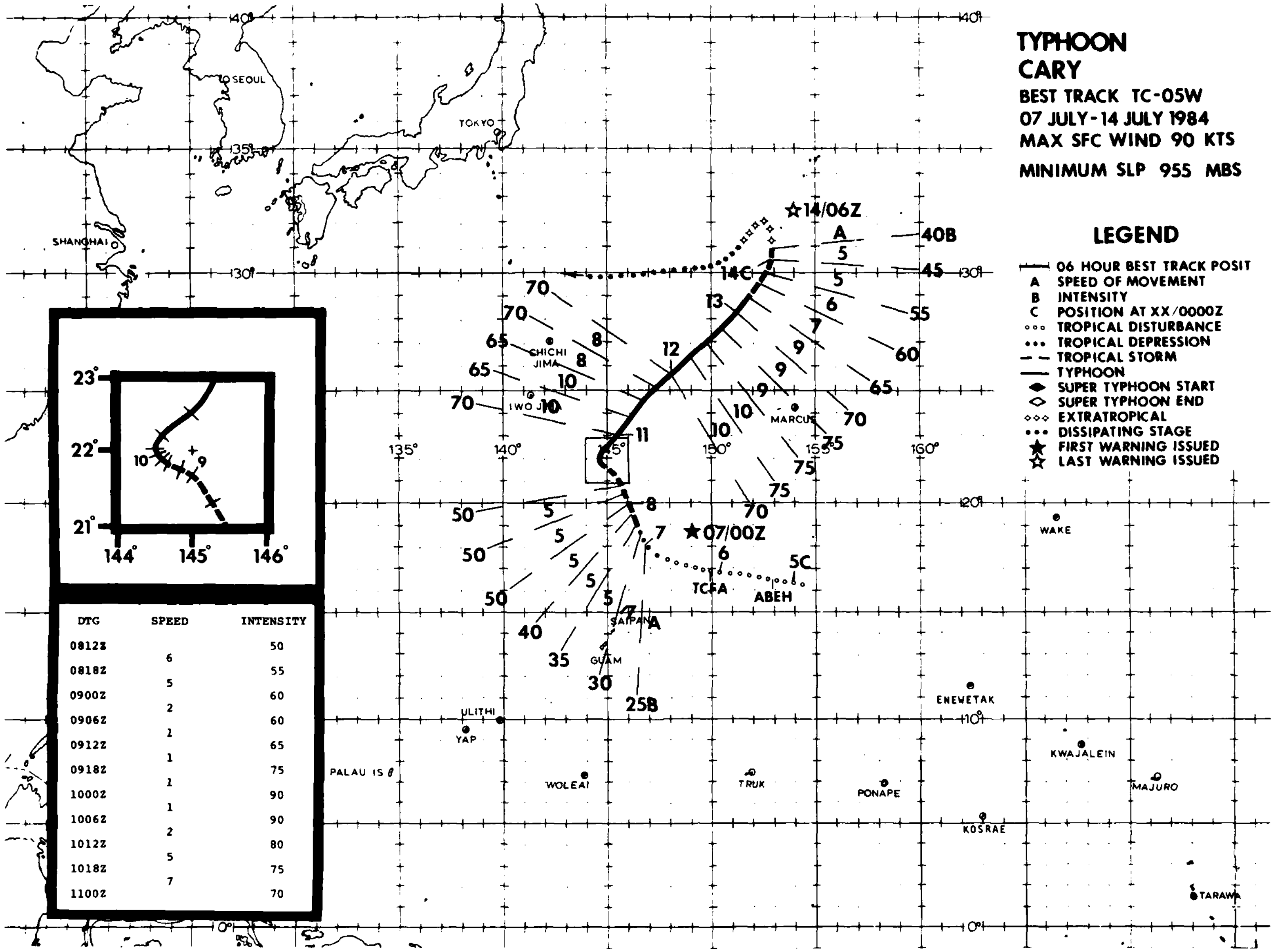
The Hong Kong Royal Observatory (WMO 45005) picked up Betty on weather radar at approximately 080300Z and transmitted position fixes until 090600Z. These hourly reports aided greatly in positioning the tropical storm during this period.

Between 0600Z on the 8th and 0600Z on the 9th, Betty maintained an intensity of 50 to 55 kt (26 to 28 m/s), making landfall at 090300Z approximately 135 nm (250 km) west-southwest of Hong Kong. Figure 3-04-3 shows Betty at maximum intensity just prior to landfall. Dissipation occurred after 091800Z over the southwestern portion of the Peoples Republic of China. No forecast problems were encountered with Tropical Storm Betty since it moved steadily to the northwest around the southwestern periphery of the subtropical ridge.

Figure 3-04-3. Tropical Storm Betty at maximum intensity of 55 kt (28 m/s) just prior to landfall (090137Z July DMSP visual imagery).

TYPHOON CARY

BEST TRACK TC-05W
07 JULY-14 JULY 1984
MAX SFC WIND 90 KTS
MINIMUM SLP 955 MBS



DTG	SPEED	INTENSITY
0812Z		50
	6	
0818Z		55
	5	
0900Z		60
	2	
0906Z		60
	1	
0912Z		65
	1	
0918Z		75
	1	
1000Z		90
	1	
1006Z		90
	2	
1012Z		80
	5	
1018Z		75
	7	
1100Z		70

TYPHOON CARY (05W)

Typhoon Cary was the first storm of the season to be initiated by the Tropical Upper Tropospheric Trough (TUTT) in a manner similar to that described by Sadler (1976). While remaining over water its entire life, Cary distinguished itself by unusual intensity changes.

The disturbance which eventually developed into Typhoon Cary was first noticed on the 2nd of July as an area of very poorly organized convection near 18N 168E in the eastern, divergent side of a westward moving TUTT cell. During the next two days, the convection remained poorly organized as it moved to the west-southwest. Surface synoptic data indicated only easterly trades were present beneath the convection. Early on the 5th, the convection became more organized with satellite imagery indicating an anticyclone developing aloft over the system; however, due to sparse surface reports, the presence of a surface circulation could not be confirmed. Because of the improved organization, the area of convection was mentioned in the 050600Z Significant Tropical Weather Advisory (ABEH PGTW). Subsequent satellite imagery showed continued development of the convection and the ABEH was reissued at 051200Z indicating that the potential for significant tropical cyclone development was "fair" (meaning that it is likely that a TCFA will be issued during the advisory period). Early on the 6th, satellite imagery (Figure 3-05-1) showed that the convection had become comma shaped, with evidence that a surface circulation was forming. Consequently a TCFA was issued at 060317Z. During the following 21 hours the disturbance moved to the west-northwest, with no significant intensification.

Aircraft reconnaissance late on the 6th, had no trouble locating a surface circulation and reported that the disturbance had an MLSP of 1004 mb with estimated maximum surface winds of 25 kt (13 m/s). Based on this report, the first warning on Cary was issued at 0000Z on the 7th. During the next 12 hours, satellite imagery indicated the depression was slowly intensifying. This was confirmed by the next aircraft reconnaissance flight which found Cary had intensified to storm strength with a narrow band of 35 to 40 kt (18 to 21 m/s) surface winds north of its center and an MSLP of 999 mb.

Cary continued to intensify as it moved to the northwest toward an apparent break in the subtropical ridge. Due to uncertainty in the Fleet Numerical Oceanography Center (FNOC) analysis fields in the data sparse region southeast of Japan, 400 mb synoptic track missions were flown on 8 and 9 July to better define the mid-level flow north of Cary. These flights confirmed the presence of a weakness in the ridge, which indicated that forecasts for slow northwestward movement with eventual recurvature to the northeast were sound. Cary slowed as it approached the weakness in the subtropical ridge while continuing to intensify. At 091200Z, Cary was upgraded to typhoon status based on aircraft and satellite data which indicated that a 30 nm (56 km) wide eye had formed, 700 mb flight level winds were 64 kt (33 m/s), and an MSLP of 975 mb existed. During the subsequent 12 hours Cary intensified quite rapidly, reaching a maximum intensity of 90 kt (46 m/s) with an MSLP of 955 mb at 092332Z. Figure 3-05-2 shows Cary just prior to reaching maximum intensity.

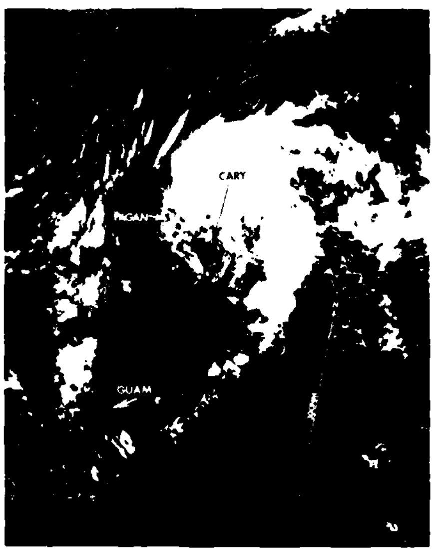


Figure 3-05-1. Satellite imagery which prompted issuance of the TCFA. Note the comma shaped convection and the exposed low-level circulation center to the southwest (060036Z July DMSP visual imagery).

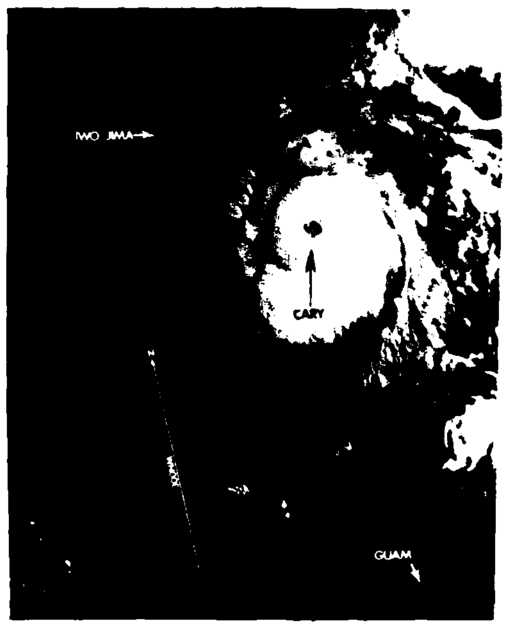


Figure 3-05-2. Typhoon Cary just prior to reaching maximum intensity (092221Z July NOAA visual imagery).

Between 0000Z on the 9th and 1200Z on the 10th, Cary moved very slowly through the ridge axis. At the same time, a mid-latitude trough was forecast to deepen in the lee of Japan, supress the subtropical ridge further south, and allow Cary to enter the westerlies and be steered to the northeast. Acceleration, although considered, was not forecast since the strong upper-level westerlies were forecast to remain well north of 30N through the forecast period.

Recurvature to the northeast was underway by 101200Z. This was accompanied by a significant shearing of the convection in the northwest semicircle of the storm (Figure 3-05-3) resulting in a reduction of intensity to near minimum typhoon strength. Approximately 18 hours later the trough approached a blocking ridge along 170E, turned to the north, and weakened. This allowed the shearing environment over Cary to decrease resulting in a gradual increase in convection and a halt to the weakening trend. At 111118Z the ARWO reported that Cary was once again developing an eye; this time 40 nm (74 km) across. This large eye persisted for 24 hours (Figure 3-05-4) as Cary reintensified. Figure 3-05-5 shows the intensity variations of Cary. Note the weakening when Cary was being sheared followed by reintensification as the upper-level environment improved.

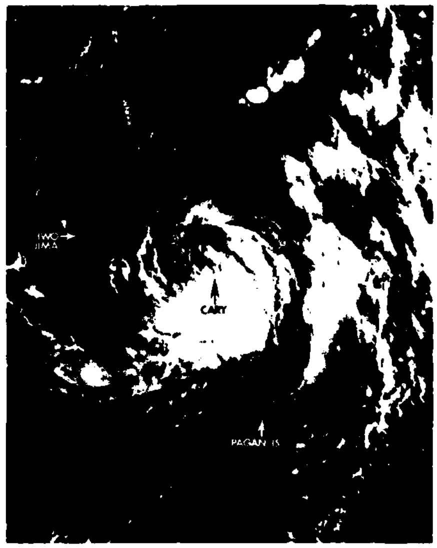


Figure 3-05-3. Typhoon Cary being sheared. Notice the complete absence of significant convection in the northwest semicircle (102156Z July NOAA visual imagery).

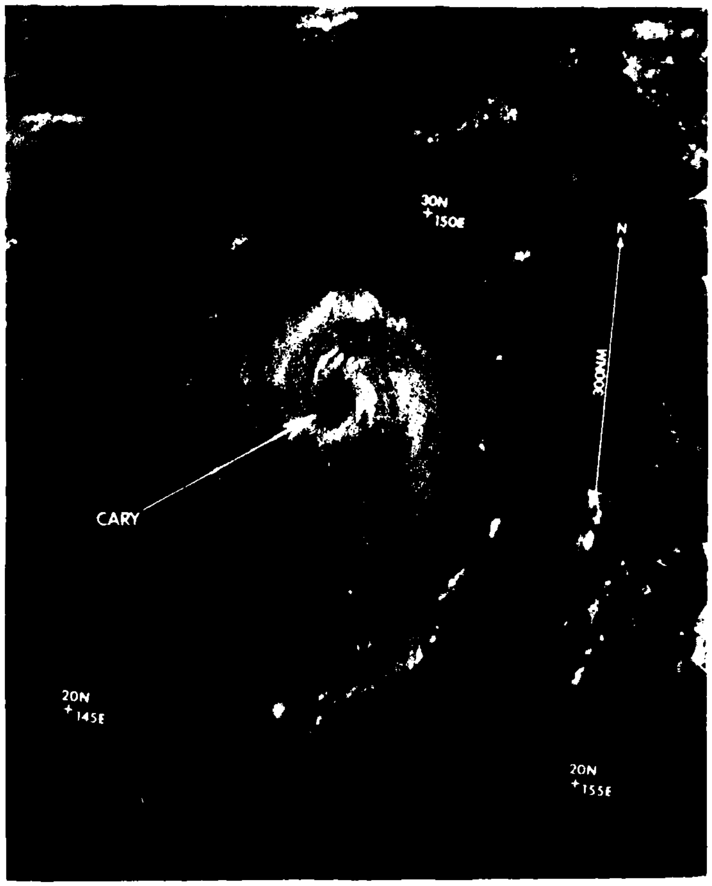


Figure 3-05-4. Typhoon Cary after reintensifying. Maximum sustained winds are 75 kt (39 m/s) (120529Z July NOAA visual imagery).

As Cary moved further north, increasing vertical shear and entrainment of cooler, drier air caused Cary to weaken and gradually become extratropical. By 140600Z Cary had completed its extratropical transition and the final warning was issued. Figure 3-05-6 shows Cary as it completed transition to an extratropical low. The extratropical remains of Cary continued to weaken and moved west under the influence of a surface ridge northeast of Japan. Cary eventually dissipated to the south of Japan. There were no reports of injuries or damages from Cary.

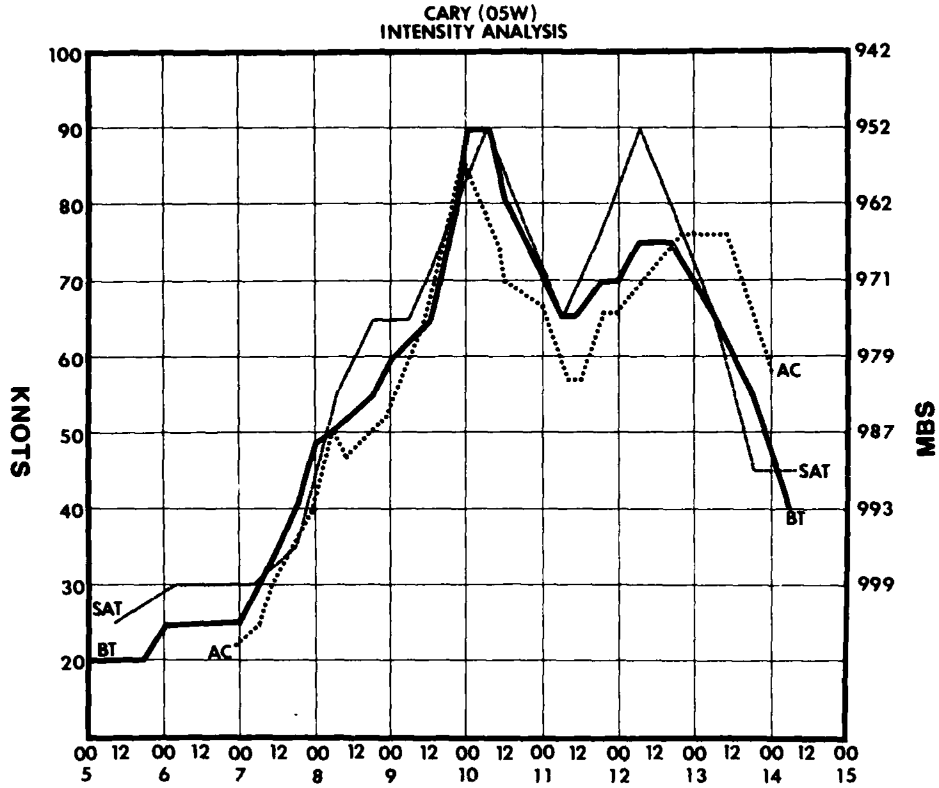


Figure 3-05-5. Satellite (Dvorak, 1973) and aircraft reconnaissance (Atkinson and Holliday, 1977) intensity estimates of Typhoon Cary. Best track intensities are shown as the solid line.

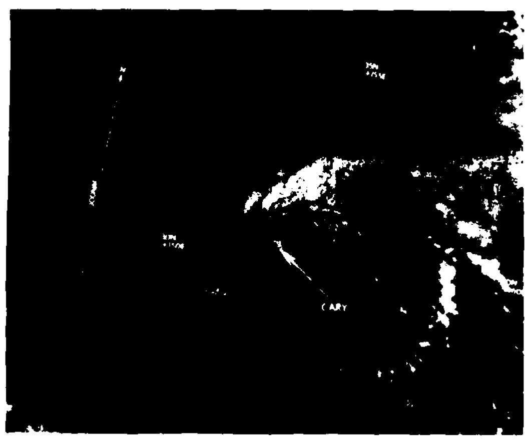
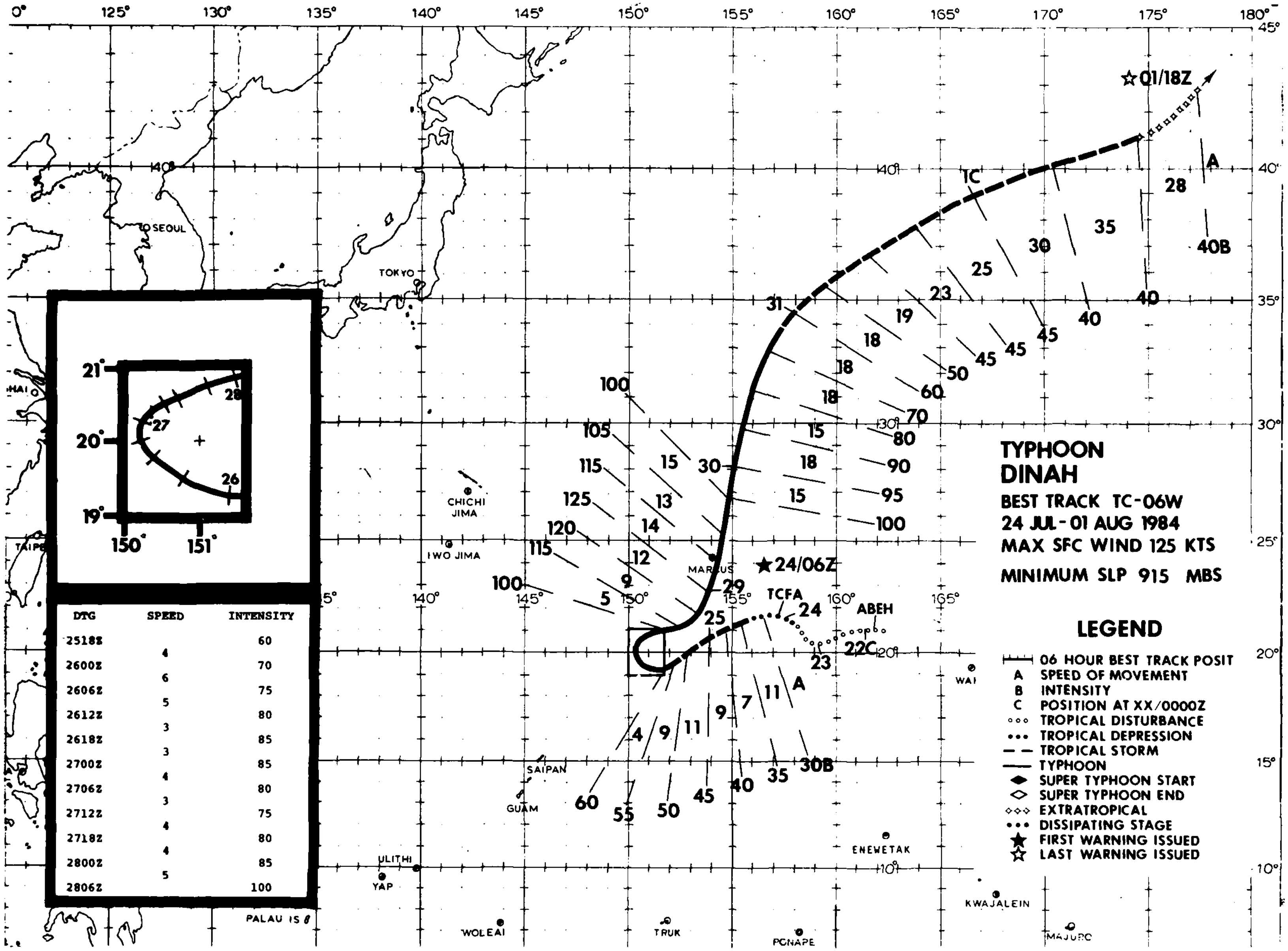


Figure 3-05-6. Cary completing extratropical transition. Note the absence of convection around the storm. Only stable stratocumulus clouds remain (140504Z July NOAA visual imagery).



DTG	SPEED	INTENSITY
2518Z		60
	4	
2600Z		70
	6	
2606Z		75
	5	
2612Z		80
	3	
2618Z		85
	3	
2700Z		85
	4	
2706Z		80
	3	
2712Z		75
	4	
2718Z		80
	4	
2800Z		85
	5	
2806Z		100

During much of July, the North Pacific was dominated by slow moving or stationary features. After Tropical Storm Betty dissipated over southern China, the southwest monsoon did not re-develop. Instead, surface ridging was established in the South China Sea. Gradually this ridging spread eastward, and by mid-July dominated the western North Pacific from Southeast Asia to the dateline. This anomalous ridging persisted for almost two weeks. Accompanying this ridging was an almost total absence of significant convection in the tropics. With high pressure dominating the climatologically favored area for tropical cyclone development, it was up to a cold front to provide the genesis mechanism for the next storm of the season. This front had persisted for nearly a week, extending across much of the central North Pacific southwestward to just north of Wake Island (WMO 91245). While the southern end of the associated trough had, at times, shown some convective activity, it was not until the front began to move eastward that the disturbance detached from the front and developed into Typhoon Dinah.

On the 20th and 21st, satellite imagery indicated that the trough and its associated surface front, which had been inactive for nearly a week, were finally moving east. As the trough moved eastward, an area of convection remained behind and began to show some organization. Synoptic data at 1200Z on the 21st indicated a surface circulation had formed beneath the convection, approximately 300 nm (556 km) to the northwest of Wake Island. During the next two days, the disturbance drifted slowly westward with no significant development. This lack of development and slow movement are attributed to the passage to the north of a developing mid-latitude frontal system which significantly elongated the convection.

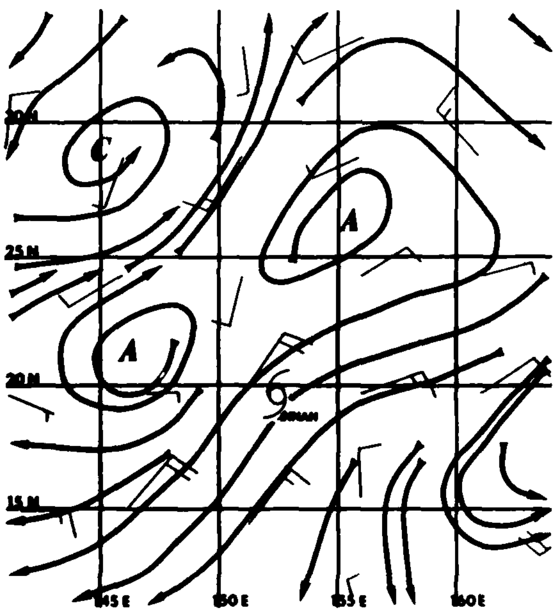


Figure 3-06-1. Mid-tropospheric wind flow which initially steered Typhoon Dinah. Note the ridge to the north with a weakness in the ridge to the northwest (FNOC 400 mb NVA analysis valid at 251200Z July).

Late on the 23rd, with the frontal system passing to the northeast and its influence lessening, the convection associated with the disturbance increased considerably. Based on the 240000Z imagery, a TCFA was issued. As the TCFA was being issued, the first aircraft reconnaissance of the disturbance was already underway. By 240250Z the aircraft had located a 1000 mb circulation center, and had observed surface winds of 30 kt (15 m/s). Since continued development was expected, the first warning on Dinah valid at 240600Z was issued.

During the next two days, Dinah tracked to the west-southwest and intensified. Late on the 25th, Dinah attained typhoon intensity with aircraft reporting that a 30 nm (56 km) wide circular eye had formed. Dinah's track to the west-southwest is attributed to the flow around a narrow mid-tropospheric ridge to its north (Figure 3-06-1). At this time, Tropical Storm Ed (soon to be Typhoon Ed) was moving southeast towards Dinah. This caused the ridge to the north to slide to the east allowing Dinah to turn to the northwest into the weakness.

Between 0000Z on the 26th and 0000Z on the 28th, Dinah and Ed were within 900 nm (1667 km) of each other, with the closest point of approach being at 262100Z when they were approximately 630 nm (1167 km) apart (Figure 3-06-2). While JTWC was warning on these systems it was thought that the major track changes to both were a result of their interaction. However, post-analysis indicates this interaction between Dinah and Ed was not nearly as great a factor as initially thought. It is now believed that the proximity of the storms did not have a major affect on their respective tracks and only a short-lived influence on Dinah's intensity.

Figure 3-06-3 shows the intensity variations of Dinah as measured by reconnaissance aircraft. After intensifying for three days, Dinah weakened for a 12 to 24 hour period on the 27th. This weakening happened after the closest point of approach between the two storms had occurred. The mechanism responsible for this temporary weakening was the well developed outflow of Ed which interacted with Dinah late on the 26th and early on the 27th. Figure 3-06-4 contains a series of three infrared satellite pictures showing the approach and interaction of Ed's outflow with Dinah. This interaction resulted in a significant shearing and suppression of the convection

in the northwest quadrant of Dinah, a temporary weakening of the eye and eyewall and an increase in the central pressure as observed in Figure 3-06-3. Figure 3-06-5 shows an enhanced infrared picture of Typhoon Dinah after interaction with Ed had taken place. Note that the eye is open to the northwest, and there is a lack of significant convection in the northwest quadrant. Although not verifiable, Dinah's brief turn to the east-northeast on the 27th may also be attributable to the pressure from Ed's outflow. By early on the 28th, with the distances between Ed and Dinah increasing, the shearing decreased and Dinah intensified rapidly, reaching its maximum intensity of 125 kt (64 m/s) at 0000Z on the 29th.

By now Dinah was moving to the north-northeast and increasing its forward speed as the storm tracked along the westward edge of the mid-Pacific high. At approximately 290600Z Dinah made its closest point of approach to Marcus Island (Minami Tori Shima (WMO 47991)) with an intensity of 115 kt (59 m/s). This was Dinah's only interaction with land and caused extensive damage to vegetation on the island. The Coast Guard Loran station sustained an estimated $30,000 worth of damage to various buildings and equipment. Maximum observed winds on the island were 63 kt (32 m/s) with a peak gust to 89 kt (46 m/s).

Figure 3-06-2. View of Typhoon Dinah and the developing Tropical Storm Ed (soon to be Typhoon Ed) near the time of their closest point of approach (262213Z July NOAA visual imagery).

Figure 3-06-3. Intensity variations of Typhoon Dinah as derived from aircraft reconnaissance data.

After passing clear of Marcus Island, Dinah continued to move to the north-northeast at 15 to 18 kt (28 to 33 km/hr) and weaken. Early on the 31st Dinah was downgraded to a tropical storm. A mid-latitude trough which had already been interacting with Dinah for approximately 12 hours, now started steering the storm towards the northeast. Transition to an extratropical low, which began at about 1200Z on the 30th, was completed by 1200Z on the 1st of August.

The final warning was issued by the Joint Typhoon Warning Center at 1800Z on 1 August. The extratropical remains of Dinah continued to track eastward across the international dateline.

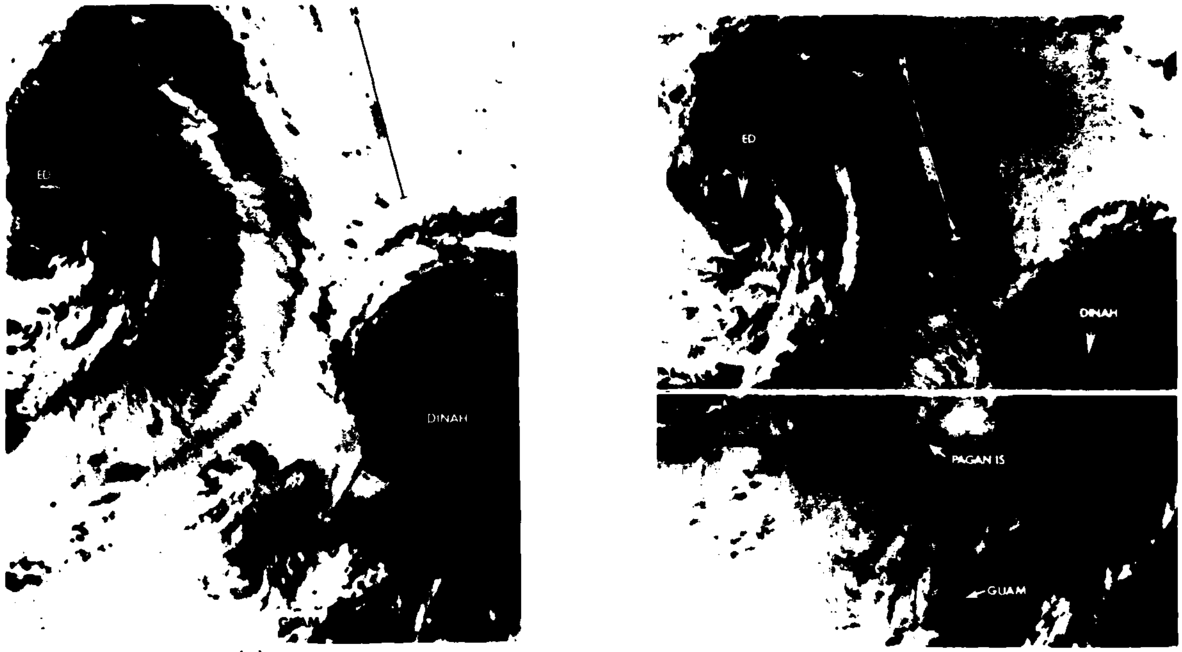


Figure 3-06-4. Three infrared pictures taken during a six hour period showing the approach of Ed's outflow and its interaction with Dinah (a. 261842Z July NOAA infrared imagery, b. 262214Z July NOAA infrared imagery, c. 270037Z July NOAA infrared imagery).

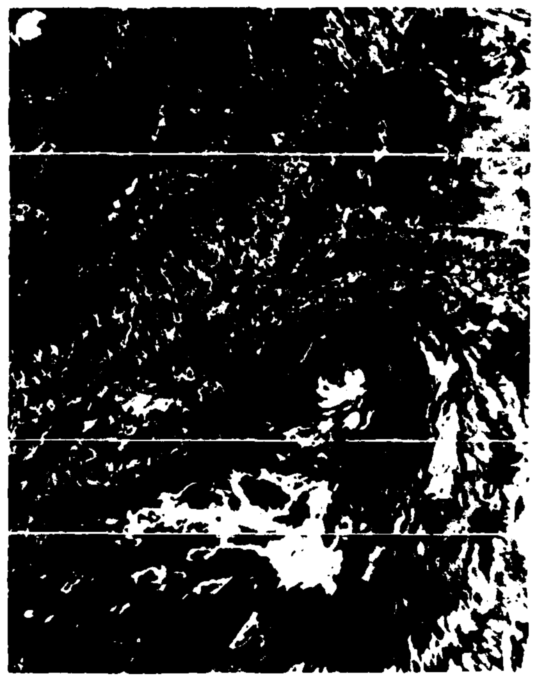
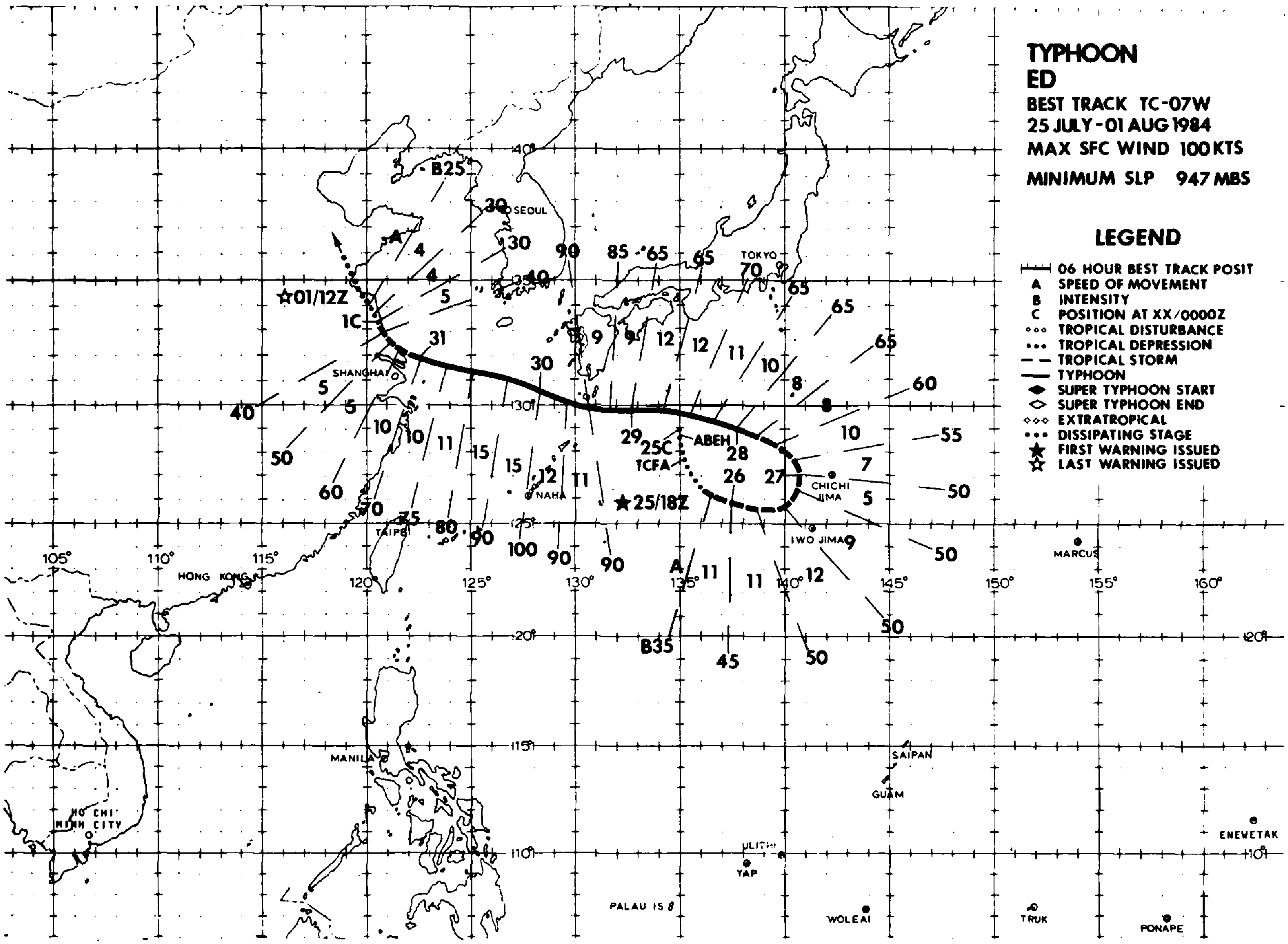


Figure 3-06-5. Enhanced infrared imagery of Typhoon Dinah after interaction with Ed (270545Z July NOAA infrared imagery).


TYPHOON
ED
BEST TRACK TC-07W
25 JULY - 01 AUG 1984
MAX SFC WIND 100 KTS
MINIMUM SLP 947 MBS
LEGEND
06 HOUR BEST TRACK POSIT
A SPEED OF MOVEMENT
B INTENSITY
C POSITION AT XX/0000Z
TROPICAL DISTURBANCE
TROPICAL DEPRESSION
TROPICAL STORM
TYPHOON
SUPER TYPHOON START
SUPER TYPHOON END
EXTRATROPICAL
DISSIPATING STAGE
FIRST WARNING ISSUED
LAST WARNING ISSUED
SEOUL
TOKYO
SHANGHAI
TAIPEI
NAHA
HONG KONG
MANILA
HO CHI MINH CITY
CHICHI JIMA
IWO JIMA
MARCUS
SAIPAN
GUAM
ULITHI
YAP
PALAU IS
WOLEAI
TRUK
PONAPE
ENEWETAK
ABEH
TCFA
25/18Z
01/12Z

Typhoon Ed, like its predecessor Typhoon Dinah, originated from a mid-latitude system. Forming just south of Japan, Ed initially moved to the southeast, a very unusual direction of movement for tropical cyclones in the northwest Pacific. After briefly interacting with Typhoon Dinah, Ed turned to the west-northwest, a course it maintained until it made landfall on the east coast of China.

The disturbance which eventually developed into Ed began as an area of convection at the southern end of a dissipating cold front transiting Japan. Although the convection was first noticed on 23 July, it was not until late on the 24th that the cloud mass became detached from the front and showed signs of becoming a tropical disturbance. At 0000Z on the 25th, synoptic data indicated a surface circulation had formed, with an MSLP near 1002 mb. Satellite imagery and synoptic data indicated an upper-level anticyclone had developed over the disturbance providing excellent outflow to the south. These developments prompted the Significant Tropical Weather Advisory (ABEH PGTW) to be reissued at 250135Z in order to include this system as a suspect area. The potential for significant tropical cyclone development was assessed as being "fair". Indeed this was an understatement. The area rapidly transitioned from an extratropical feature to a tropical depression as the convection increased and became more organized. At 250600Z, synoptic data showed surface pressures had decreased to 999 mb and Dvorak satellite intensity analysis estimated that surface winds of 30 kt (15 m/s) were present. Consequently a TCFA was issued at 250745Z. The disturbance continued to develop overnight and the first warning on Ed was issued at 1800Z on the 25th.

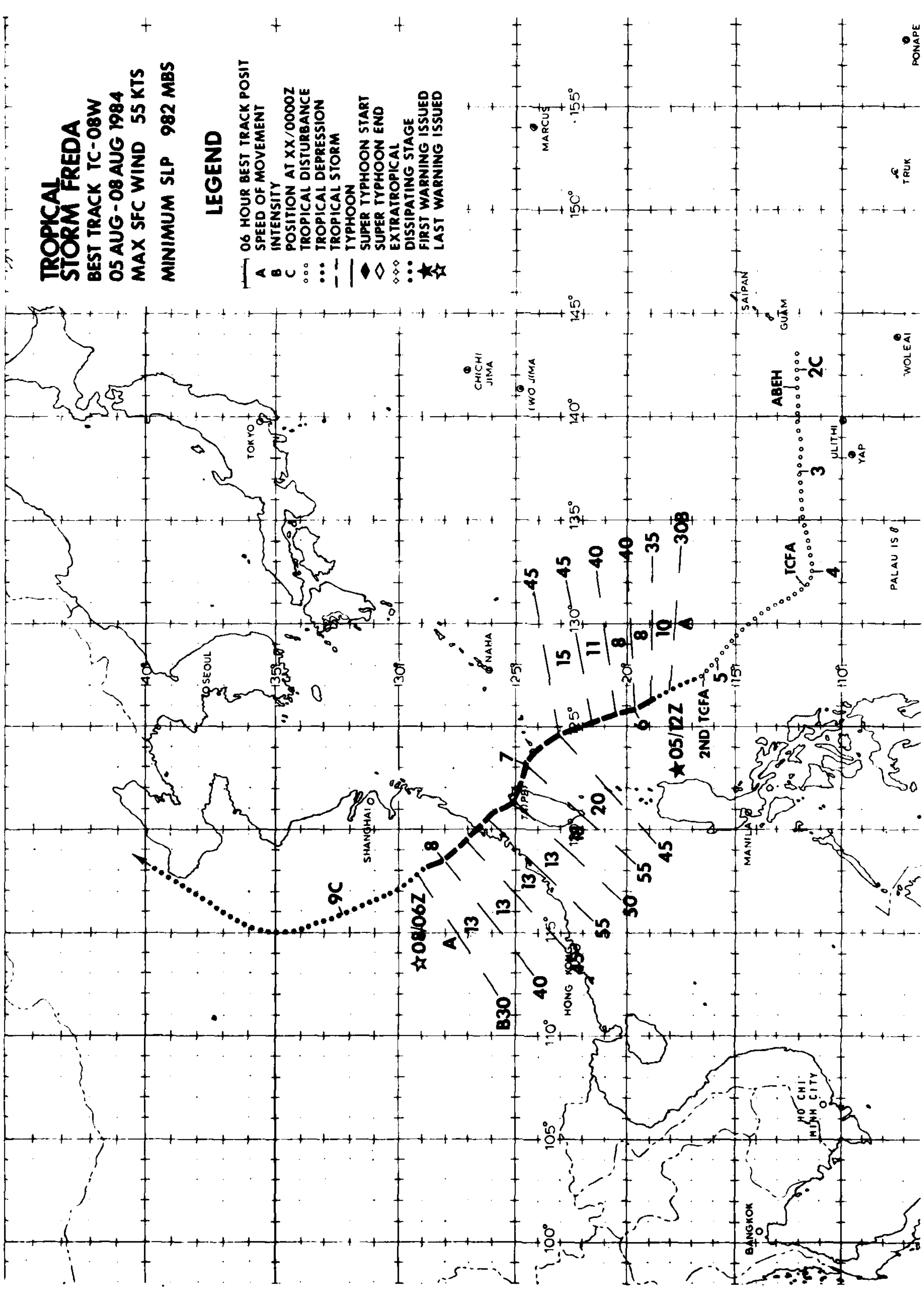
While Ed was developing, Typhoon Dinah located approximately 900 nm (1667 km) to the southeast, was moving to the west and intensifying. The first five warnings forecast Ed to move generally towards Dinah, remain weak and eventually be assimilated into Dinah's inflow. However, Ed did not remain weak but continued to intensify as it moved to the southeast. Aircraft reconnaissance at 252219Z found Ed had deepened to 985 mb and was supporting winds of 40 to 50 kt (21 to 26 m/s). Ed maintained a 50 kt (26 m/s) intensity during the next 24 hours as it moved closer to Dinah. Throughout this period, Ed's outflow remained very well organized and was elongating to the east towards Dinah. This outflow had a significant short term effect on Dinah's convection and intensity early on the 27th.

During the 26th, a short-wave trough moved eastward across the Sea of Japan. In response to the trough, Ed turned to the north while maintaining its intensity. By 270000Z, the trough had moved to the northeast and was weakening. Ed now came under the influence of a mid to low-level ridge east of Japan. This ridge kept building to the west and forced Ed to move to the west-northwest, a course it maintained until landfall.

While moving to the west Ed slowly intensified, reaching its peak intensity of 100 kt (51 m/s) shortly after passing south of the island of Kyushu (Figure 3-07-1). As Ed transited the East China Sea, entrainment of drier air and passage over cooler waters began to weaken the system. At 0900Z on the 31st, Ed made landfall approximately 60 nm (111 km) north of Shang-Hai (WMO 58367). Maximum sustained winds at landfall were 60 kt (31 m/s). After making landfall, Ed turned to the northwest, transited along coastal China and gradually dissipated. The final warning was issued at 1200Z on the 1st of August.

The only known damage caused by Typhoon Ed occurred to shipping. The Korean registered Ishlin Glory enroute from Pohang, South Korea to Nagoya, Japan sank in the Korea Strait on 29 July. One crew member is known dead, with eleven others reported missing.

Figure 3-07-1. Typhoon Ed near maximum intensity (292242Z July NOAA visual imagery).


TROPICAL STORM FREDA
BEST TRACK TC-08W
05 AUG - 08 AUG 1984
MAX SFC WIND 55 KTS
MINIMUM SLP 982 MBS
LEGEND
06 HOUR BEST TRACK POSIT
SPEED OF MOVEMENT
INTENSITY
POSITION AT XX/0000Z
TROPICAL DISTURBANCE
TROPICAL DEPRESSION
TROPICAL STORM
TYPHOON
SUPER TYPHOON START
SUPER TYPHOON END
EXTRATROPICAL
DISSIPATING STAGE
FIRST WARNING ISSUED
LAST WARNING ISSUED

TROPICAL STORM FREDA (08W)

Tropical Storm Freda was the first of seven significant tropical cyclones to develop during August. Freda began just as Typhoon Ed was dissipating over eastern China and Typhoon Dinah was completing its extra-tropical transition well to the east of Japan. In the wake of these two typhoons, the atmosphere had not yet returned to its seasonally normal condition before Freda began to show signs of developing. This situation meant that Freda would be slow to develop and take several days to pull together into a tropical cyclone.

On the 1st of August, just prior to the development of Freda, the western Pacific was dominated at the surface by a deep trough extending southwest from Dinah into a disturbance north of Guam and then south-westward into the southern Philippine Sea (Figure 3-08-1). The southwest monsoon, which had re-established itself during the last week of July, had not yet returned to its climatological position and would not do so for several more days. The low-level convergence at the base of this trough west of Guam, was the primary genesis mechanism for Freda. By 020600Z, enough convection had developed over the area to merit inclusion of the disturbance in the Significant Tropical Weather Advisory (ABEH PGTW). At 021200Z, a closed surface circulation was first analyzed in the Philippine Sea with an estimated MSLP of 1005 mb. The ABEH was reissued shortly thereafter upgrading the potential for significant tropical cyclone development to "fair". An aircraft investigation of the area was requested for the following after-noon. Although at this time it was assumed that the disturbance would progress into a typical tropical cyclone, it would turn out that the most difficult part of warning on this storm would be locating the surface center.

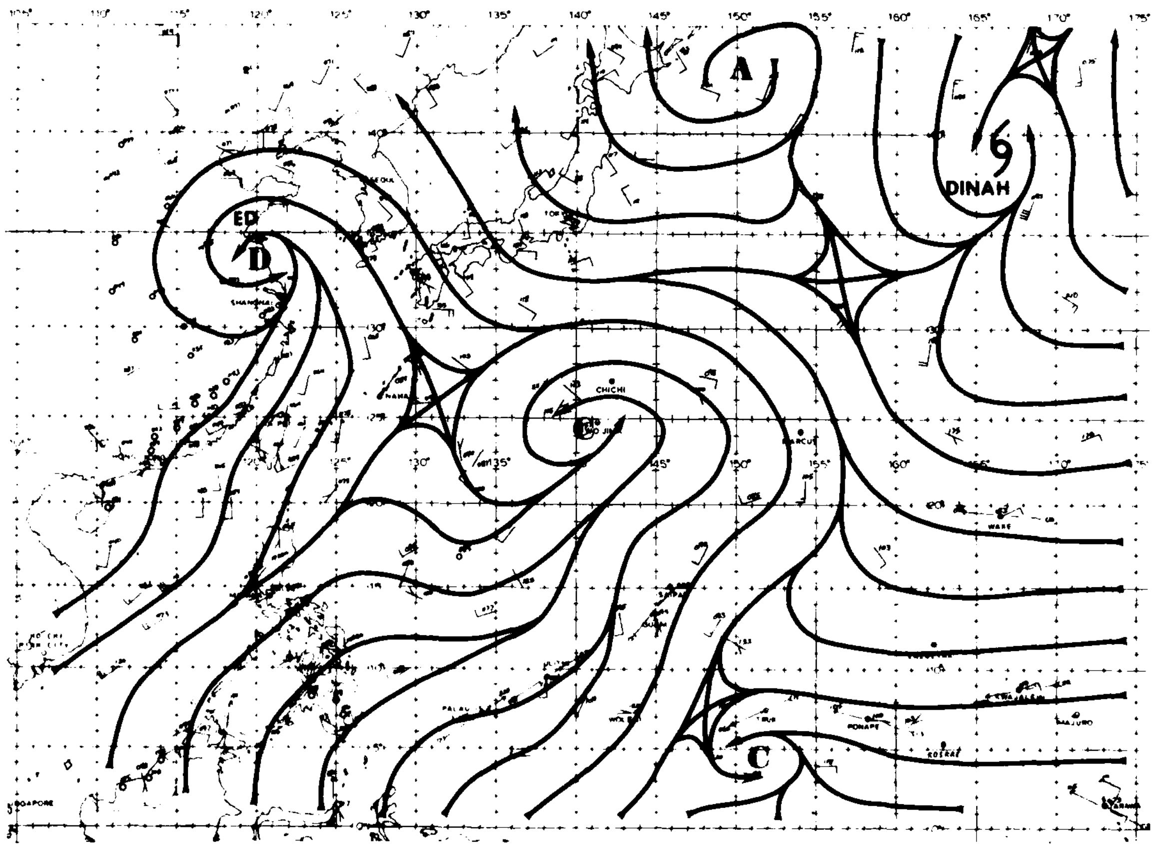


Figure 3-08-1. The 010000Z August 1984 surface/gradient level analysis. Low-level convergence at the base of the trough west of Guam was the primary genesis mechanism for Tropical Storm Freda.

Since the forecast scenario was not very difficult, and Freda followed a general track to the northwest, the remainder of the discussion will focus of Freda's development through aircraft reconnaissance and the subsequent results.

Mission number one was a resources-permitting invest on the afternoon of 3 August. It found a very broad, light and variable wind center but could not locate a definite closed circulation. The MSLP reported by the aircraft was 1003 mb. JTWC continued to watch the area and requested another invest for the following morning with a stand-by fix for later that afternoon. The second invest closed-off a 25 kt (13 m/s) circulation near 11.0N 132.7E. However, satellite imagery at that time revealed that the disturbance was developing very slowly. The MSLP observed on the second flight was 1005 mb or two millibars higher than on the previous day - not a promising sign. Since development was occurring so slowly, the afternoon stand-by fix was cancelled and the metwatch continued.

In anticipation of continued slow development during the next twenty-four hours, a TCFA was issued at 040415Z. Two fix missions were also requested for the following day. Mission number three, originally tasked as a fix mission for the morning of 5 August, could not find the system at the forecast location. Reverting to an invest pattern, the crew was still unable to locate a circulation center, although they did find a broad trough some 5 degrees further north than on the previous day. The lowest surface pressure reported was 999 mb. In rapid succession mission number four, the afternoon fix, was cancelled; the TCFA was reissued and positioned further to the northwest; and another aircraft invest was requested for the next morning with a follow-on afternoon fix. At 050716Z, Dvorak satellite intensity analysis of the imagery in Figure 3-08-2 indicated the disturbance was developing and estimated that surface winds of 30 kt (15 m/s) were now present. Based on the satellite intensity estimates, the lower pressures reported by aircraft and the forecast for continued slow intensification, JTWC issued the first warning on Freda as a tropical depression at 051200Z.

Figure 3-08-2. Dvorak intensity analysis of this imagery indicated 30 kt (15 m/s) winds were present prompting the first warning on Freda (050716Z August NOAA visual imagery).

Mission number five, an invest scheduled for NLT 060000Z, finally found a 993 mb circulation center with winds in excess of 35 kt (18 m/s) after several hours of searching. Mission number six, an afternoon fix mission, had little trouble fixing the circulation center of this now 40 kt (21 m/s) tropical storm. At last Freda was showing signs of cooperating; however, this was not to last long! The ARWO on mission number six commented, " This storm was rather weak and unorganized. It was very large and could very well have multiple centers." Indeed this was the case. Satellite imagery indicated there were now two centers of activity - the second one developing to the north of the circulation fixed by the aircraft (Figure 3-08-3). Up until this time the fixes from both aircraft and satellite as well as the forecast emphasis had been on the southern center, but the northern area was about to assume dominance. The apparent storm movement from 060600Z to 070000Z was as much a reconsolidation around the northern center as it was a simple translation of the entire storm envelope to the northwest. This

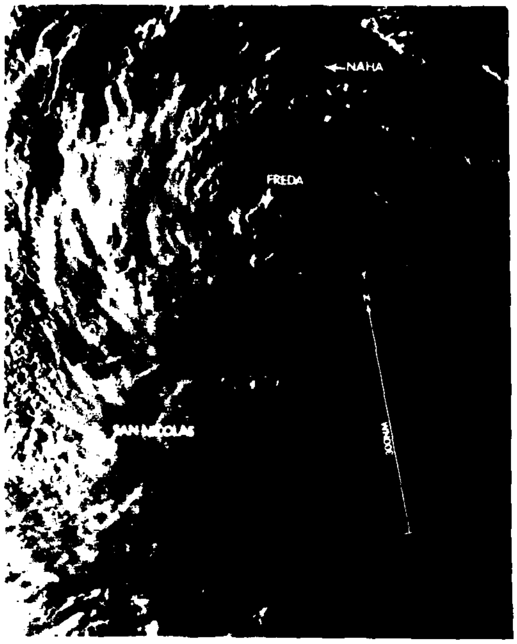
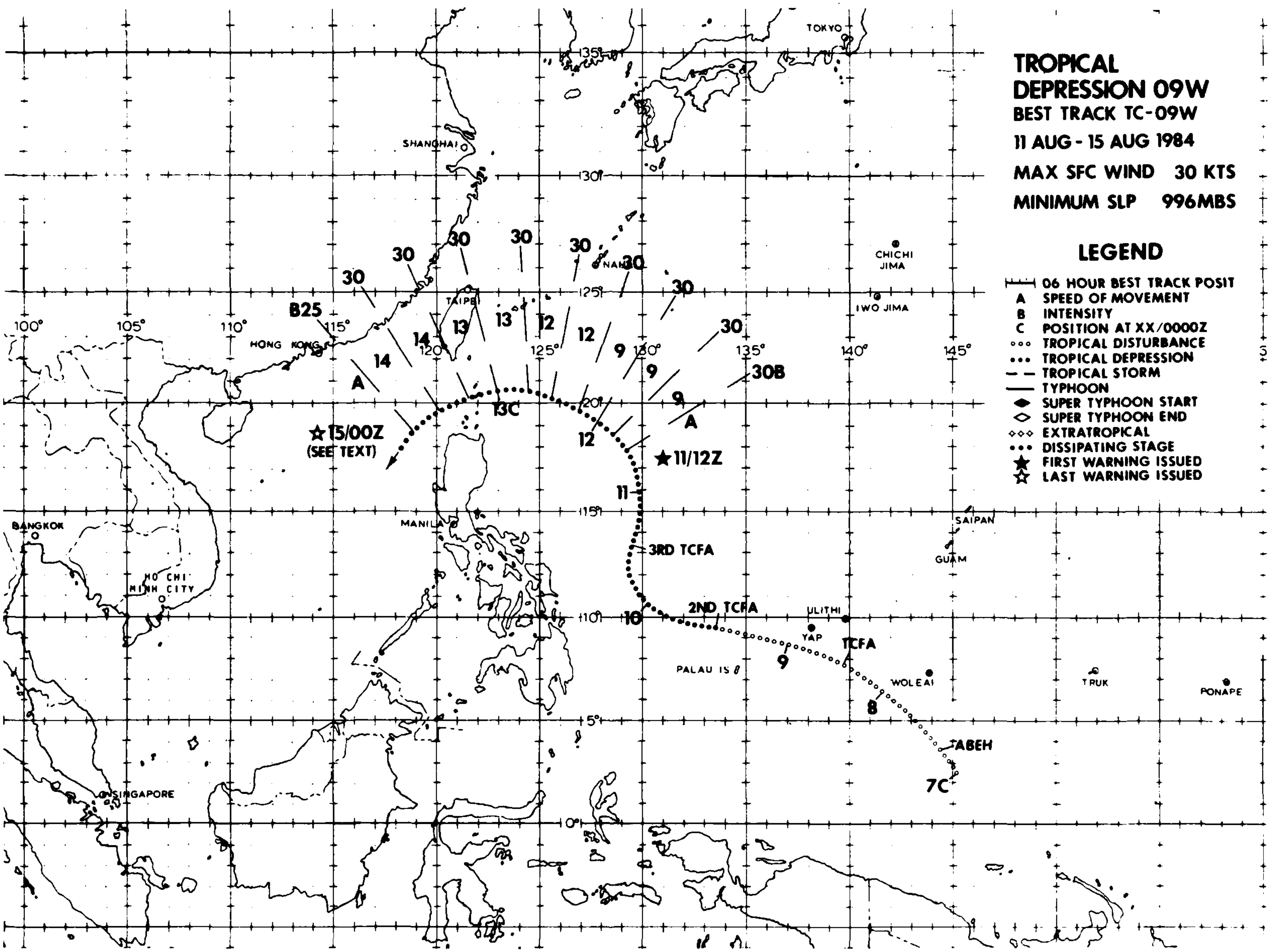


Figure 3-08-3. Tropical Storm Freda when reconsolidation about the northern center was about to commence. Note the southern area of convection, where the aircraft and satellite had been fixing the center and a second area of convection located further to the north where the new center would develop (061010Z August DMSP visual imagery)

reconsolidation was complicated by the fact that it occurred at night when only infrared satellite imagery was available. When mission number seven went into Freda the next morning, it could not find a circulation where the southern center should have been. However, when the pattern was changed to that of an invest mission they found Freda located significantly to the northwest within the northern area of convection. The MSLP had now decreased to 988 mb with maximum surface wind of 45 kt (23 m/s) being reported. Mission number eight, the last one flown into Freda, was unable to penetrate the center since the storm had moved over Taiwan.

Freda quickly transited northern Taiwan and the Formosa Straits before making landfall on the Chinese mainland at approximately 071500Z. Like Typhoon Ed, a week earlier, Freda held together over land for two more days before finally dissipating.

In summary, Tropical Storm Freda was a slow developing system that exhibited two centers of action for a portion of its life. The southern center was more dominant until reconsolidation around the northern center occurred just prior to Freda crossing Taiwan. Freda tracked generally to the northwest and was identifiable over land for several days after it moved ashore.


TROPICAL
DEPRESSION 09W
BEST TRACK TC-09W
11 AUG - 15 AUG 1984
MAX SFC WIND 30 KTS
MINIMUM SLP 996MBS
LEGEND
06 HOUR BEST TRACK POSIT
A SPEED OF MOVEMENT
B INTENSITY
C POSITION AT XX/0000Z
TROPICAL DISTURBANCE
TROPICAL DEPRESSION
TROPICAL STORM
TYPHOON
SUPER TYPHOON START
SUPER TYPHOON END
EXTRATROPICAL
DISSIPATING STAGE
FIRST WARNING ISSUED
LAST WARNING ISSUED
TOKYO
SHANGHAI
TAIPEI
NAHA
HONG KONG
CHICHI JIMA
IWO JIMA
SAIPAN
GUAM
MANILA
BANGKOK
HO CHI MINH CITY
SINGAPORE
ULITHI
YAP
PALAU IS
WOLEAI
TRUK
PONAPE
★11/12Z
☆15/00Z (SEE TEXT)
3RD TCFA
2ND TCFA
TCFA
ABEH
7C
B25
30B
13C

TROPICAL DEPRESSION (09W)

Tropical Depression 09W, just like its predecessor Tropical Storm Freda, was a difficult storm to warn on. The depression's low-level circulation remained weak and poorly organized which made it very difficult to locate. Extensive post-analysis indicates that JTWC warned on the mid-level circulation, which was co-located with the organized convection, rather than the ill-defined low-level center which remained well to the south of the main convection.

Tropical Depression 09W first appeared early on the 7th of August as a broad 1006 mb low in the Near-Equatorial Trough approximately 660 nm (1222 km) south of Guam. The disturbance was mentioned on the 070600Z Significant Tropical Weather Advisory (ABEH PGTW). As it moved to the northwest, the disturbance showed signs of increased organization on satellite imagery, prompting the issuance of a TCFA at 081200Z.

Aircraft reconnaissance on the afternoon of 9 August, indicated that the surface circulation associated with the disturbance was broad and weak. Only 10 to 15 kt (5 to 8 m/s) surface winds were observed with an MSLP of 1004 mb. The TCFA was reissued daily from the 9th to the 11th as the system continued to show convective organization and the presence of a surface circulation in the synoptic data. During this period, the disturbance was very slow to develop a favorable upper-level circulation. The 200 mb flow persisted in being unidirectional (easterly) over the convection. This easterly flow sheared the convection preventing the accumulation of warm, moist air at the low-to-mid levels and the attendant surface pressure drop.

The aircraft reconnaissance investigative flight on the morning of 10 August could not find a surface circulation center. By this time, the system had moved out of the Near-Equatorial Trough and had become the south-eastern extension of the monsoon trough.

Between 100600Z and 110600Z, the disturbance moved almost due north. This brought the disturbance under the influence of a TUTT cell located to the northwest near Taiwan. The 200 mb flow over the system now came from the south and was diffluent north through east of the surface circulation. Satellite imagery confirms this by indicating the presence of the heaviest convection in that area. At 110729Z, aircraft reconnaissance closed-off a surface circulation center with 25 kt (13 m/s) surface winds and an MSLP of 1003 mb. Based on the improved upper-level wind flow and the closed circulation found by aircraft, the first warning on Tropical Depression 09W was issued at 111200Z.

The first six warnings on 09W forecast it to move to the northwest. These forecasts were based on objective forecast aids, including the One-Way Interactive Tropical Cyclone Model (OTCM). Upon post-analysis, these forecasts do not agree well with the synoptic situation present at the time. A low-to-middle level ridge was located to the north of the depression. In retrospect, the more accurate and synoptically correct forecast, especially with such a weak system as Tropical Depression 09W, would have been a west-northwest to west track along the northern side of the monsoon trough.

Complicating the forecasting of Tropical Depression 09W was the difficulty in positioning the surface center. The surface circulation center was poorly organized because it was embedded in the monsoon trough. The displacement of the mid-to-upper level circulation to the north within the convection, made accurate positioning by satellite imagery of the actual low-level depression center very difficult. Figure 3-09-1 shows one of the few times that the weak, poorly defined, low-level circulation was visible on satellite imagery. Post-analysis of aircraft reconnaissance, synoptic, and satellite data, shows that the depression center, as reflected in the warning positions, was the middle-to-upper level center and not the weak and poorly defined surface circulation center which was located approximately 150 nm (278 km) to the south. JTWC warned on this mid-level feature until 150000Z when the convection finally dissipated over Taiwan and it was obvious that no significant low-level circulation persisted. It is now apparent that the surface center moved along the monsoon trough as a sheared, sometimes exposed low-level circulation from 111200Z to 131800Z and dissipated shortly thereafter as it merged with a cyclonic circulation in the northern South China Sea. This circulation would develop into Tropical Storm Gerald a few days later.

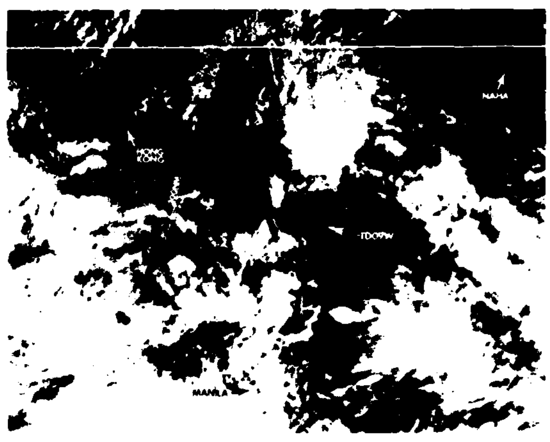


Figure 3-09-1. Tropical Depression 09W passing south of Taiwan. Note the poorly defined exposed low-level circulation located well to the south of the main convection. At the time, the depression's center was thought to be located underneath this convection. However, post-analysis now indicates the exposed low-level circulation was the actual location of the depression's center (130718Z August NOAA visual imagery).

TROPICAL STORM GERALD
BEST TRACK TC-10W

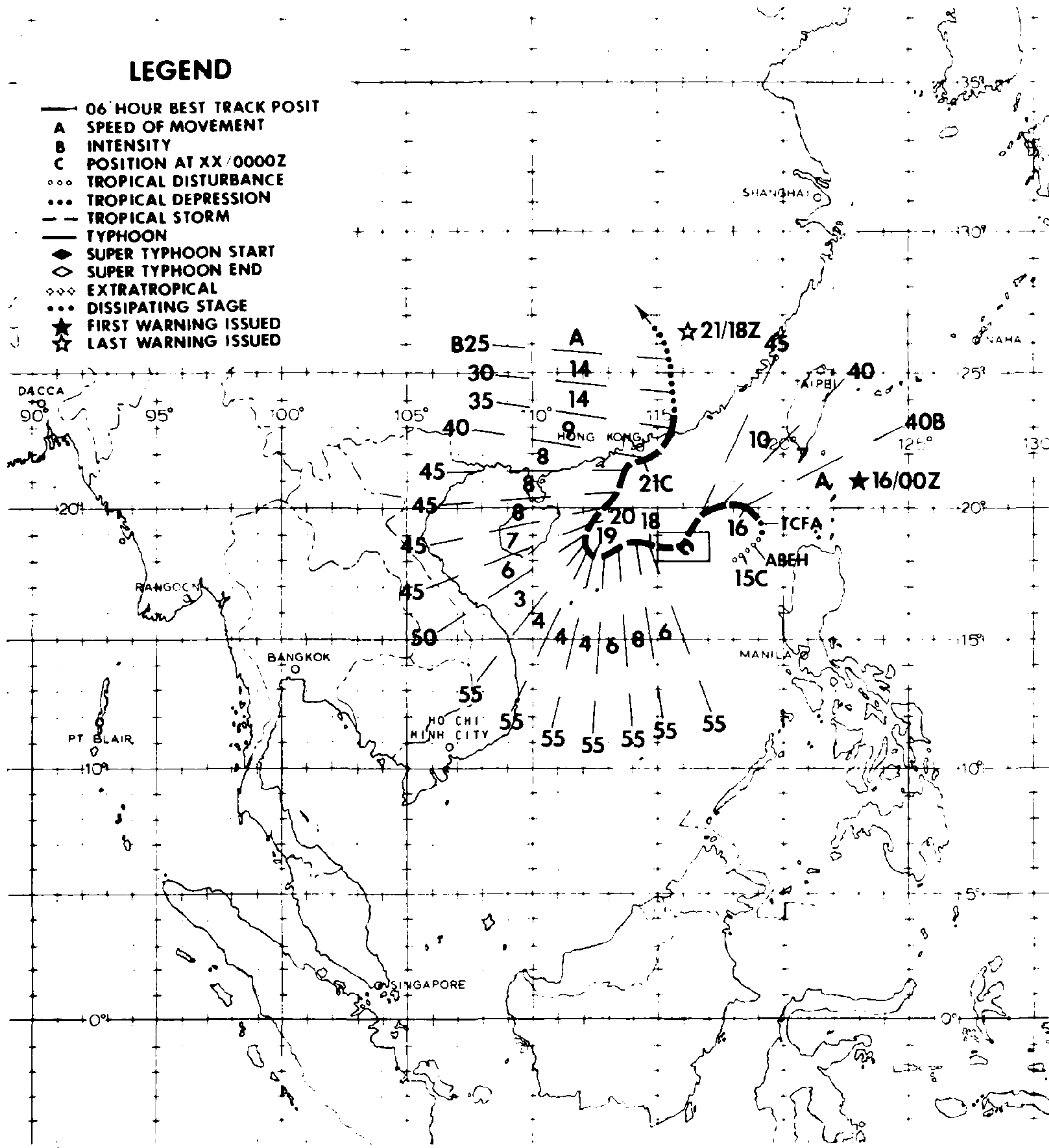
16 AUG - 21 AUG 1984

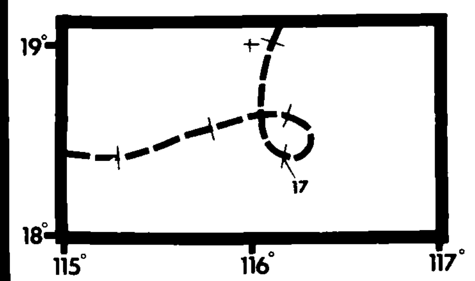
MAX SFC WIND 55 KTS

MINIMUM SLP 979 MBS

LEGEND

- —— 06 HOUR BEST TRACK POSIT
- A SPEED OF MOVEMENT
- B INTENSITY
- C POSITION AT XX/0000Z
- ∘∘∘ TROPICAL DISTURBANCE
- ••• TROPICAL DEPRESSION
- — — TROPICAL STORM
- —— TYPHOON
- ◆ SUPER TYPHOON START
- ◇ SUPER TYPHOON END
- ◇◇◇ EXTRATROPICAL
- ••• DISSIPATING STAGE
- ★ FIRST WARNING ISSUED
- ☆ LAST WARNING ISSUED





DTG	SPEED	INTENSITY
1612Z		45
	9	
1618Z		45
	6	
1700Z		50
	4	
1706Z		50
	4	
1712Z		50
	5	
1718Z		55
	6	
1800Z		55

TROPICAL STORM GERALD (10W)

Tropical Storm Gerald led a rather uneventful life. Developing in the northern South China Sea, Gerald remained embedded in the monsoon trough for five days. Its proximity to Typhoon Holly affected both its track and intensity. By the time it made landfall, it had weakened to a minimal tropical storm causing little, if any, damage.

By mid-August, the southwest monsoon had returned to its climatological position. The associated monsoon trough now extended from northern Vietnam across the northern South China Sea and then southeast to just south of Guam. As Tropical Depression 09W developed east of the Luzon Straits, the trough deepened. By the 12th of August, synoptic data indicated a closed surface circulation had formed in the northern South China Sea near 18N 117E with an MSLP near 1001 mb. The circulation continued to develop and at 131200Z the MSLP had decreased to 998 mb with winds near the center of 10 to 20 kt (5 to 10 m/s); 20 to 30 kt (10 to 15 m/s) winds were located south of the circulation center associated with the southwest monsoon.

By 141800Z the convection associated with remnants of Tropical Depression 09W near Taiwan, had nearly dissipated. Up to this point there was very little significant convection in the northern South China Sea. The convection that was present showed no real organization. Between 141800Z and 150000Z, the convection in the northern South China Sea increased considerably. Surface pressures had now decreased to 997 mb. However, winds near the center were light - only 5 to 15 kt (3 to 8 m/s), while the 20 to 30 kt (10 to 15 m/s) winds still persisted further south - a classic monsoon depression.

The entire monsoon trough had been discussed on the Significant Tropical Weather Advisory (ABEH PGTW) since 130600Z. However, with improved convective organization and lower pressures being observed in the northern South China Sea, this disturbance finally warranted inclusion on its own merits in the 150600Z ABEH.

Synoptic data at 151200Z indicated a broad circulation still persisted, but now 15 to 30 kt (8 to 15 m/s) winds were being reported much closer to the center. This prompted the issuance of a TCFA at 151327Z. Less than 12 hours later the first aircraft reconnaissance mission found the system had deepened to 991 mb and was supporting 40 kt (21 m/s) winds near the center. The first warning on Gerald, valid at 160000Z, followed shortly.

During the next three days, Gerald moved erratically on a generally westward course, remaining embedded in the monsoon trough. Gerald continued to intensify reaching its maximum intensity of 55 kt (28 m/s) at 171800Z. Gerald then maintained this intensity for the next two days. The inability of Gerald to intensify beyond 55 kt (28 m/s) was due to a strong shear over the storm primarily from the outflow of Typhoon Holly which had developed east of Taiwan on 16 August and persisted throughout most of Gerald's life. This shearing occasionally resulted in the low-level circulation being exposed east of the convection (Figure 3-10-1).

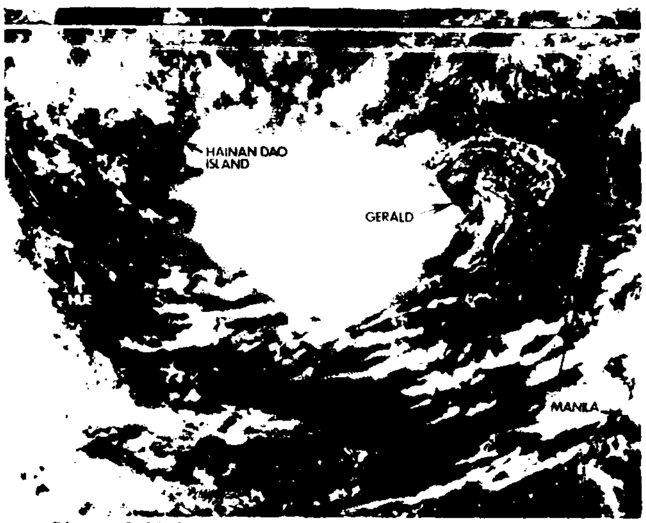


Figure 3-10-1. Example of the partially exposed low-level circulation of Tropical Storm Gerald which was observed periodically during the storm's lifetime. Note the strong easterly flow aloft shearing the convection to the west. This shear was caused by the outflow of Typhoon Holly located far to the northeast (170200Z August DMSP visual imagery).

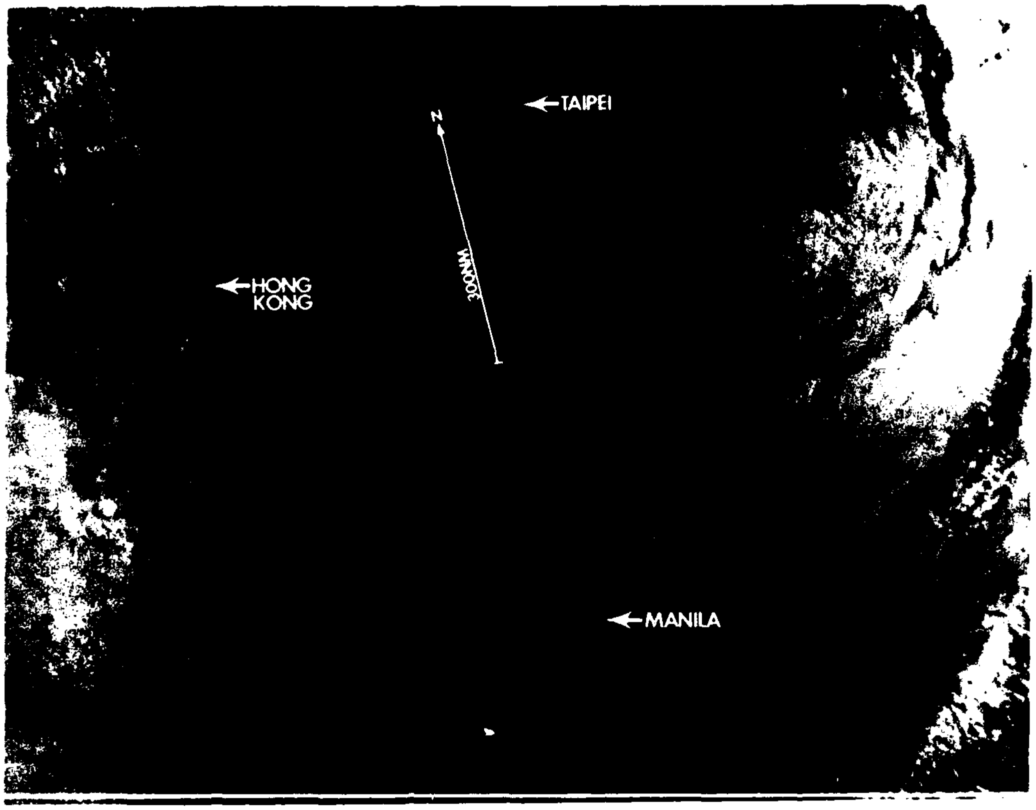


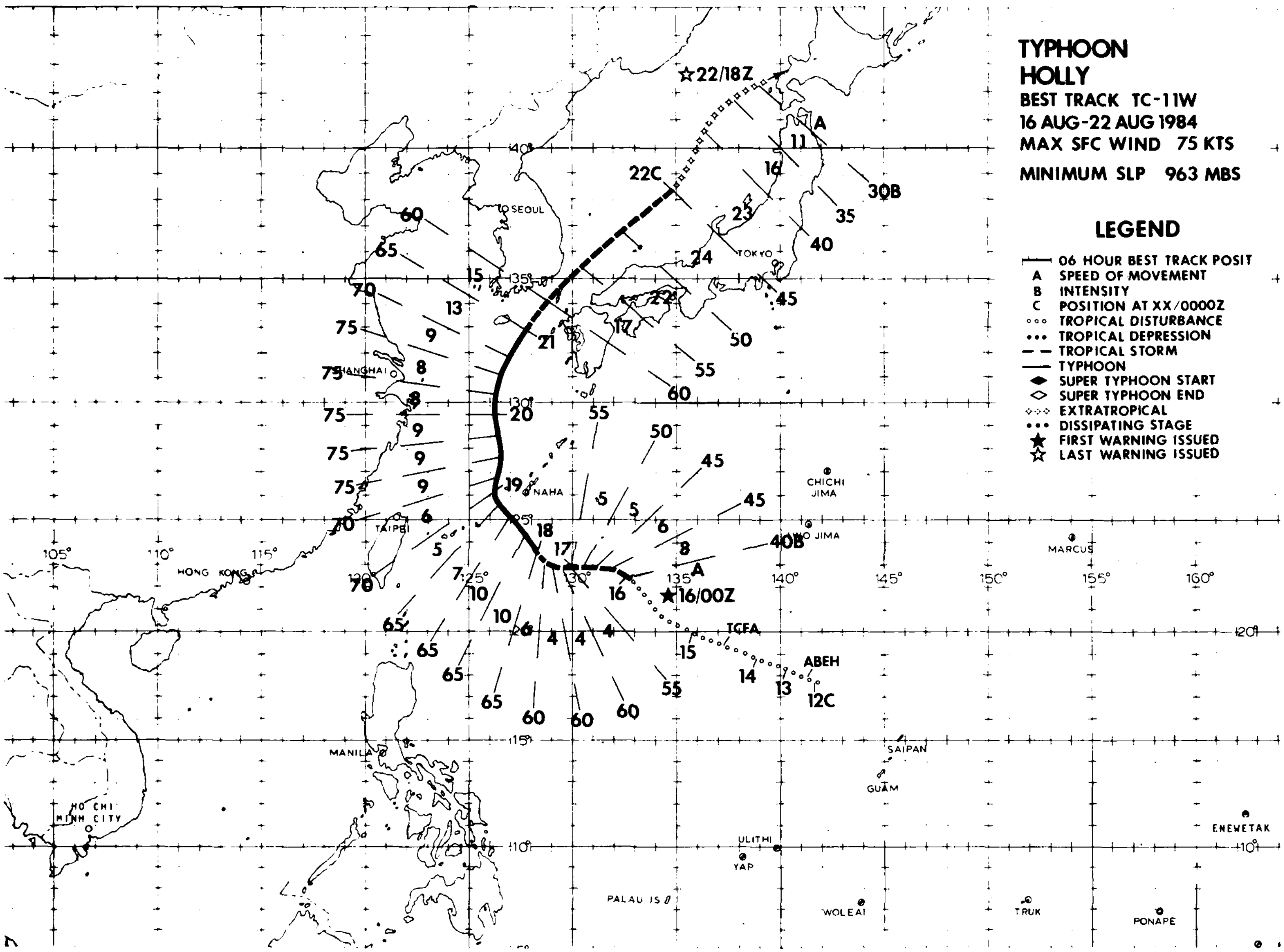
Figure 3-10-2. Tropical Storm Gerald and the developing Typhoon Holly near the time of their closest point of approach. At this time they were approximately 800 nm (1482 km) apart (172327Z August NOAA visual imagery).

Forecasting Gerald's movement proved to be difficult. Initially most forecast aids and JTWC's official forecast aid called for the storm to move northwest and make landfall over China. However, as Holly intensified and moved west Gerald slowed its westward movement, doing a small cyclonic loop early on the 17th. When Gerald slowed and moved to the south, the forecast scenario changed and called for Gerald to remain quasi-stationary for twelve to twenty-four hours, and then move slowly northeast under the influence of the inflow pattern of the developing Typhoon Holly. Figure 3-10-2 shows Tropical Storm Gerald and the developing Typhoon Holly near their closest point of approach. However, after completing its loop, Gerald once again resumed its westward course as Holly turned to the northwest.

Starting at 191800Z, Gerald turned to the northeast as the very large mid-level circulation of Typhoon Holly, now located in the East China Sea, again affected Gerald. Accompanying this turn to the northeast was a decrease in the convection as the shearing increased. This began a weakening trend which continued until dissipation.

Gerald accelerated to the northeast and weakened making landfall at 210400Z approximately 50 nm (93 km) east-northeast of Hong Kong (WMO 45005). The closest point of approach to Hong Kong was at 210100Z when Gerald passed 30 nm (56 km) to the southeast.

After making landfall, Gerald turned to the north and weakened rapidly as Holly's influence decreased. Reports from the coastal stations along southern China indicated winds of 20 to 30 kt (10 to 15 m/s) accompanied Gerald as it made landfall. There were no reports of damages as Gerald moved inland over China and dissipated.


TYPHOON
HOLLY
BEST TRACK TC-11W
16 AUG-22 AUG 1984
MAX SFC WIND 75 KTS
MINIMUM SLP 963 MBS
LEGEND
06 HOUR BEST TRACK POSIT
A SPEED OF MOVEMENT
B INTENSITY
C POSITION AT XX/0000Z
TROPICAL DISTURBANCE
TROPICAL DEPRESSION
TROPICAL STORM
TYPHOON
SUPER TYPHOON START
SUPER TYPHOON END
EXTRATROPICAL
DISSIPATING STAGE
FIRST WARNING ISSUED
LAST WARNING ISSUED
☆22/18Z
22C
★16/00Z
TCFA
ABEH
12C
30B
40B
SEOUL
TOKYO
SHANGHAI
NAHA
TAIPEI
HONG KONG
MANILA
HO CHI MINH CITY
CHICHI JIMA
IWO JIMA
MARCUS
SAIPAN
GUAM
ENEWETAK
ULITHI
YAP
PALAU IS
WOLEAI
TRUK
PONAPE

TYPHOON HOLLY (11W)

Typhoon Holly formed in the eastern extension of the monsoon trough at the same time that Tropical Storm Gerald was forming in the South China Sea. It was the fourth significant tropical cyclone to develop in the trough in less than two weeks. Holly was unusual in that it never was, by definition, a tropical depression. Because it evolved from a very active monsoon trough, Holly was already at tropical storm strength when it finally attained a closed circulation. Despite only reaching a maximum intensity of 75 kt (39 m/s), Holly significantly affected much of the western North Pacific due to its large wind field.

Even as Tropical Depression 09W was transiting the Luzon Straits, synoptic data indicated that a very active trough with poorly organized convection persisted to the east. At 131200Z the monsoon trough extended from the weakening Tropical Depression 09W eastward to just northwest of Guam. By 141200Z the eastern end of the trough had moved northwest and become sharper. Synoptic data indicated the trough had deepened with an MSLP near 1000 mb. Numerous 20 to 35 kt (10 to 18 m/s) ship reports existed south of the trough axis in the active southwest monsoon. Organization of the convection over the trough also improved during this period, and suggested that a surface circulation was forming. These developments prompted the issuance of the first of two TCFAs at 141515Z.

The first aircraft reconnaissance mission into the disturbance at 0000Z on the 15th found only a sharp trough with 25 kt (13 m/s) surface winds and an MSLP of 998 mb. At 151200Z synoptic data indicated that the southwest monsoon along with a tight pressure gradient between the monsoon trough and the subtropical ridge to the northeast, were now generating gale force winds both north and south of the trough axis. This occurred before any closed circulation was analyzed. These areas of gale force winds were contained in a NAVOCEANCOMCEN Guam (WWPN PGTW) extratropical wind warning bulletin.

The second aircraft investigative mission into the disturbance closed-off a circulation center at 160225Z and found that the MSLP had decreased to 992 mb. Gale force winds were observed within two degrees of the center. The first warninng, valid at 160000Z, was issued shortly thereafter with Holly at tropical storm strength.

Determination of the initial intensities of Holly and its associated 30 kt (15 m/s) wind radii were difficult since the gale force monsoon flow extended for hundreds of miles to the south and east of the storm. At first, the monsoon flow was included as a gale area in the NAVOCEANCOMCEN Guam extra-tropical wind warnings. However, as Holly developed, it took the monsoon flow into its circulation and subsequently became a very large storm. Figure 3-11-1, the 180600Z surface analysis, shows the very large area influenced by Holly. Aircraft and satellite data also indicated that Holly was abnormally large.

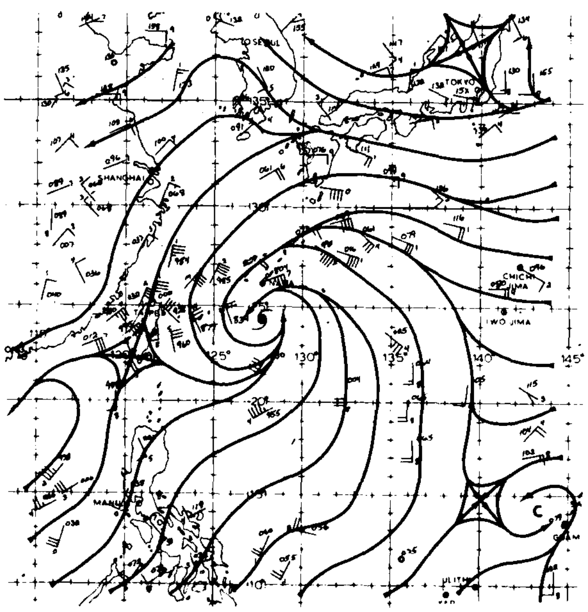


Figure 3-11-1. Surface analysis at 180600Z showing the large circulation of Typhoon Holly. Holly was still consolidating the monsoonal flow into its circulation at this time.

Figure 3-11-2 shows the wind field associated with Holly as reported by reconnaissance aircraft on 18 August. This flight was representative of the data obtained on many of the missions while Holly was a typhoon. The center was characterized by a large area of lighter winds. It was not until the aircraft was more than 60 nm (111 km) from the center that it encountered winds above 50 kt (26 m/s). Generally throughout the life of Holly, the highest winds were found in a band 60 to 150 nm (111 to 278 km) from the center. Within this band, the strongest winds were usually observed in the northern and eastern portions of the storm. The winds observed at Kadena AB, Okinawa confirmed the aircraft reports. The strongest winds observed at Kadena were in two different periods: from 171300Z to 180900Z and from 190200Z to 191700Z when gusts above 50 kt (26 m/s) were reported. Lighter winds, corresponding to the passage of the huge center, were reported between these periods. The maximum sustained wind reported at Kadena was 50 kt (26 m/s) at 191355Z with a peak gust to 72 kt (37 m/s) at 190850Z. Fortunately, despite the strong winds and the 16.76 in (425 mm) of rain, there were no deaths or serious damage reported on Kadena AB. However, some 16,000 air and ferry travelers were stranded on the island during Holly's passage. Figure 3-11-3 shows Holly as it passed west of Okinawa. Notice the very large area covered by Holly's circulation.

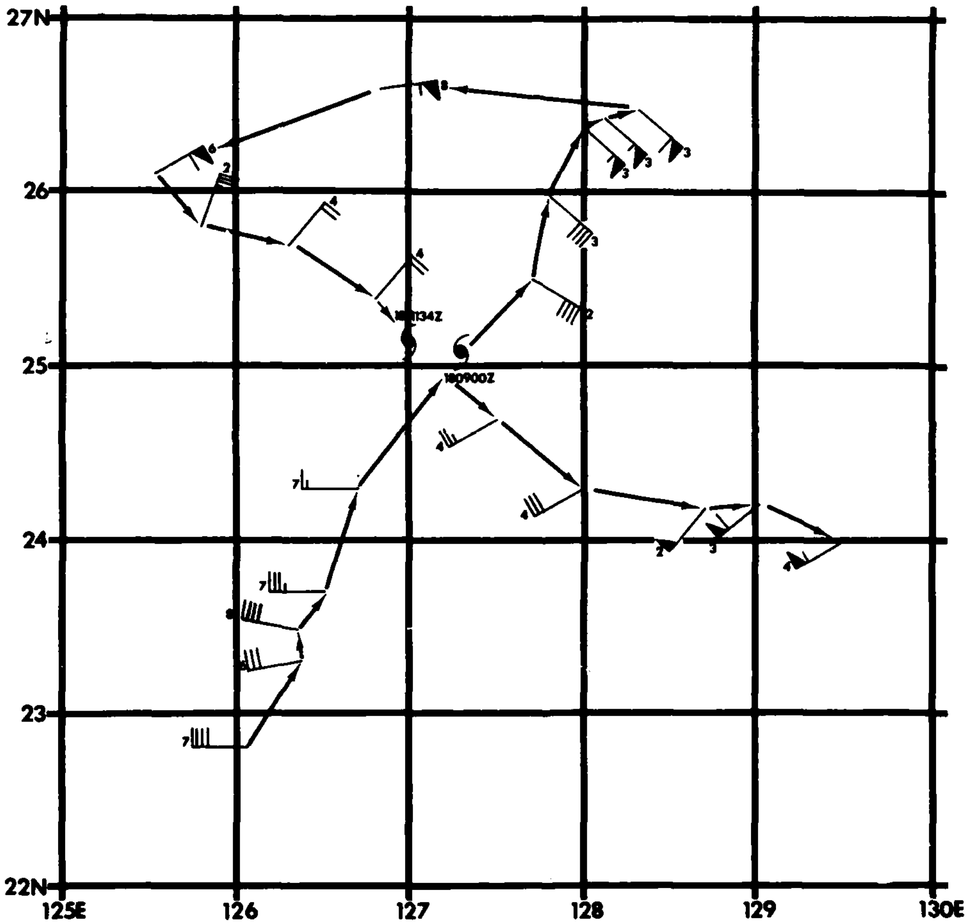


Figure 3-11-2. Plot of aircraft reconnaissance data from the seventh mission into Typhoon Holly. Holly's center was fixed at 180900Z and 181134Z August. Wind barbs are the measured 700 mb winds. The tens digit in the wind direction is plotted with the wind barb.

Holly initially moved to the west under the influence of the subtropical ridge, reaching typhoon intensity at 180000Z. At that time Holly had turned to the northwest, a course it maintained for almost 30 hours. After passing west of Okinawa, Holly turned to the north as it moved around the western periphery of the weakening subtropical ridge. Holly plodded to the north for the next twenty-four hours with no significant intensity changes. At this point the westerlies began to influence the storm. Holly was steered to the northeast and began to accelerate. Holly's forward speed peaked at 24 kt (49 km/hr) just prior to its transition to an extratropical low.

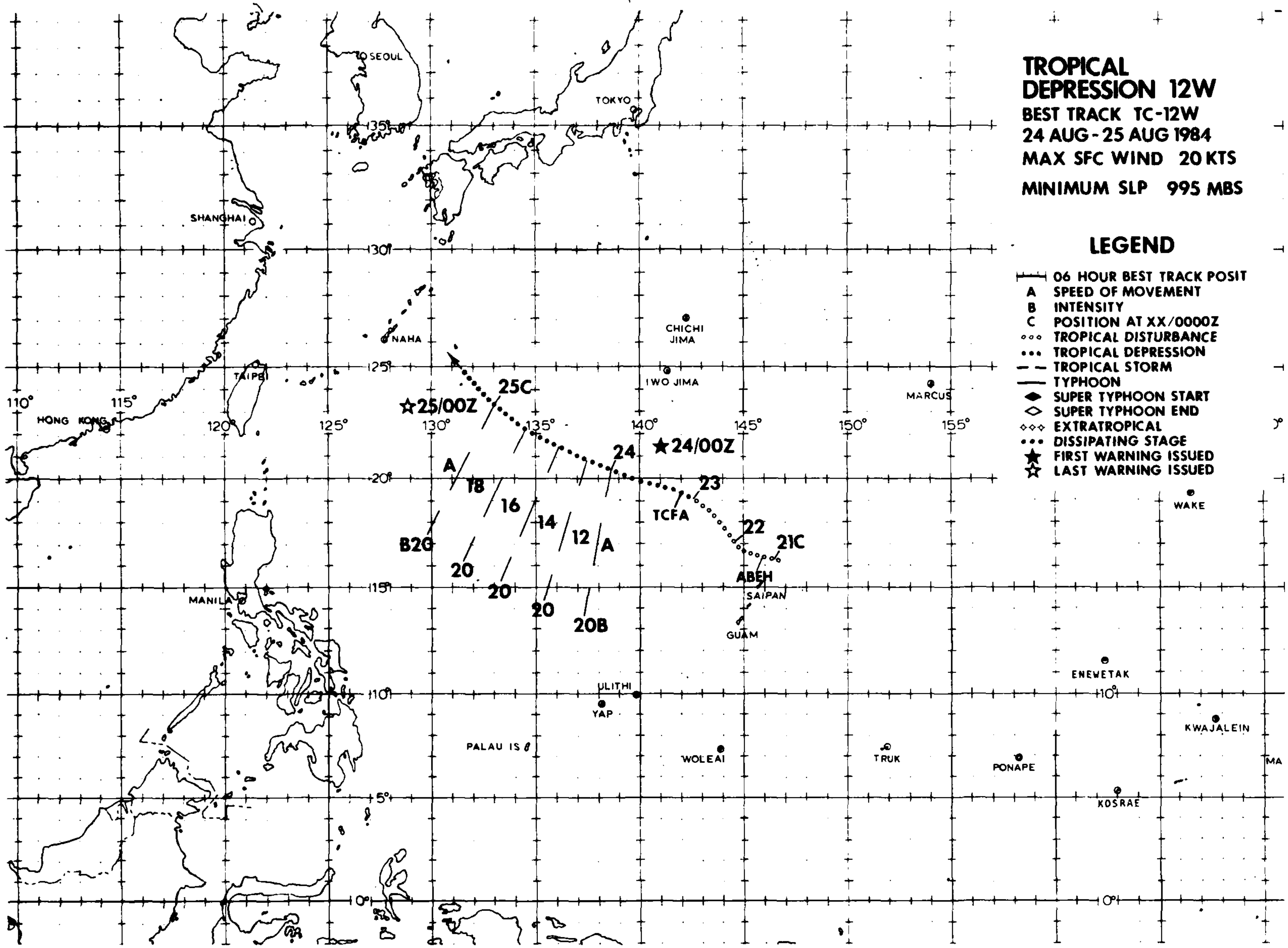
As Holly passed through the Korean Strait, it inflicted considerable damage on the Korean peninsula and the Japanese Island of Kyushu. News reports indicated at least one person killed, nine missing and eleven injured. Property damage was estimated initially at one million dollars. Heavy rainfall accompanied the storm. Miyazake (WMO 47830) on Kyushu recorded 15 inches (381 mm) of rain during a twenty-four hour period. Extensive flooding and landslides were also reported.

Holly weakened as it transited the Korean Strait due to interaction with the rugged terrain. As Holly entered the Sea of Japan, it began transitioning to an extra-tropical system. Figure 3-11-4 shows Holly shortly after completing the extratropical transition. What little convection remains is associated with the front while the exposed low-level circulation is composed of stable stratocumulus clouds. The final warning was issued at 221800Z as Holly neared the island of Hokkaido.

Overall, the JTWC forecasts on Typhoon Holly provided good decision assistance to JTWC's customers. Kadena AB was provided the time needed to evacuate its planes, and South Korea and Japan had sufficient warning time to prepare and thus minimize damage. Even though Holly was not one of the strongest storms of the season, it definitely had a major impact on much of the northwest Pacific.

Figure 3-11-3. Typhoon Holly passing just west of Okinawa. Notice the large area covered by Holly's circulation (182303Z August NOAA visual imagery).

Figure 3-11-4. Holly after completing its extra-tropical transition. The low-level center is surrounded by stable stratocumulus clouds. What little convection remains is located southeast of the center and is due to the frontal system and orographic affects (220526Z August NOAA visual imagery).


TROPICAL DEPRESSION 12W
BEST TRACK TC-12W
24 AUG - 25 AUG 1984
MAX SFC WIND 20 KTS
MINIMUM SLP 995 MBS
LEGEND
06 HOUR BEST TRACK POSIT
A SPEED OF MOVEMENT
B INTENSITY
C POSITION AT XX/0000Z
TROPICAL DISTURBANCE
TROPICAL DEPRESSION
TROPICAL STORM
TYPHOON
SUPER TYPHOON START
SUPER TYPHOON END
EXTRATROPICAL
DISSIPATING STAGE
FIRST WARNING ISSUED
LAST WARNING ISSUED
SEOUL
TOKYO
SHANGHAI
NAHA
TAIPEI
HONG KONG
MANILA
CHICHI JIMA
IWO JIMA
MARCUS
WAKE
SAIPAN
GUAM
ULITHI
YAP
PALAU IS
WOLEAI
TRUK
PONAPE
ENEWETAK
KWAJALEIN
KOSRAE
25/00Z
24/00Z
25C
24
23
22
21C
TCFA
ABEH
A
18
16
14
12
A
B2G
20
20
20
20B
110°
115°
120°
125°
130°
135°
140°
145°
150°
155°
35°
30°
25°
20°
15°
10°
5°
0°

TROPICAL DEPRESSION (12W)

Tropical Depression 12W developed in the eastern periphery of the monsoon trough, a favorable position for development, but had a very brief existence. Although this system was located in an area of highly convergent low-level flow, the upper-level support, while initially favorable for development was unable to maintain itself and contributed to the depression's dissipation. The combination of a weak low-level circulation and ill-defined mid and upper-level features made satellite fixing difficult, resulting in a wide disparity between fixes. Aircraft reconnaissance also experienced difficulty in fixing this weak system.

The southwest monsoon was slow to re-develop in the wake of Typhoon Holly. Late on 20 August, with a broad trough extending across the northern Philippine Sea, an area of convection began to develop at the eastern end of the trough just to the north of Guam. Synoptic data at 210000Z indicated that a weak 1011 mb closed circulation had formed approximately 200 nm (370 km) north-northeast of Guam. These developments prompted a discussion of the disturbance in the 210600Z Significant Tropical Weather Advisory (ABEH PGTW). The disturbance tracked generally to the northwest during the next two days, and slowly consolidated.

Satellite imagery at 230000Z showed that the disturbance was separating from the trough. Dvorak satellite intensity analysis estimated that surface winds of 25 kt (13 m/s) were now associated with the system. The first aircraft reconnaissance mission was already underway, but could only find a broad weak circulation. No winds greater than 20 kt (10 m/s) were observed. During this time, a weak, upper-level anticyclone developed over the convection. Its development was aided by a TUTT cell located approximately 6 degrees to the west which provided good divergence aloft. These factors contributed to the issuance of a TCFA at 230500Z.

During the following 18 hours the disturbance showed little change. An aircraft reconnaissance mission the next morning fixed a broad wind and pressure center, with an MSLP of 999 mb. Once again no winds greater than 20 kt (10 m/s) were observed within 250 nm (463 km) of the center. Dvorak satellite intensity estimates now indicated that maximum sustained winds of 30 kt (15 m/s) were present and forecasted 35 kt (18 m/s) winds in 24 hours. Synoptic data revealed that 30 kt (15 m/s) winds were indeed present, but they were located approximately 250 nm (463 km) northeast of the disturbance's center, and were associated with the tight pressure gradient between the subtropical ridge located north of Marcus Island (Minami Tori-Shima (WMO 47991)) and the disturbance. However, upper-level support remained favorable for some intensification which meant that the disturbance would pose a threat within 36 hours to the military and civilian populations on the Ryukyu Islands. Accordingly, the first warning on Tropical Depression 12W was issued at 240000Z.

The favorable upper-level support proved to be short-lived. Visual satellite imagery at first light the next morning (Figure 3-12-1) revealed an exposed low-level circulation with the associated convective activity displaced several hundred miles to the north. Upper-level synoptic data indicated the TUTT cell had moved northwest to near Taiwan, and the convection had sheared to the north, remaining in the divergent region east of the TUTT cell. There was no longer any evidence of an upper-level anticyclone over the depression. The upper-level flow pattern over Tropical Depression 12W was now dominated by 30 to 50 kt (15 to 26 m/s) easterly winds from a large anticyclone which had been present near Japan for several days. This flow was sufficient to prevent the redevelopment of any significant convection near the low-level circulation center. With further development now

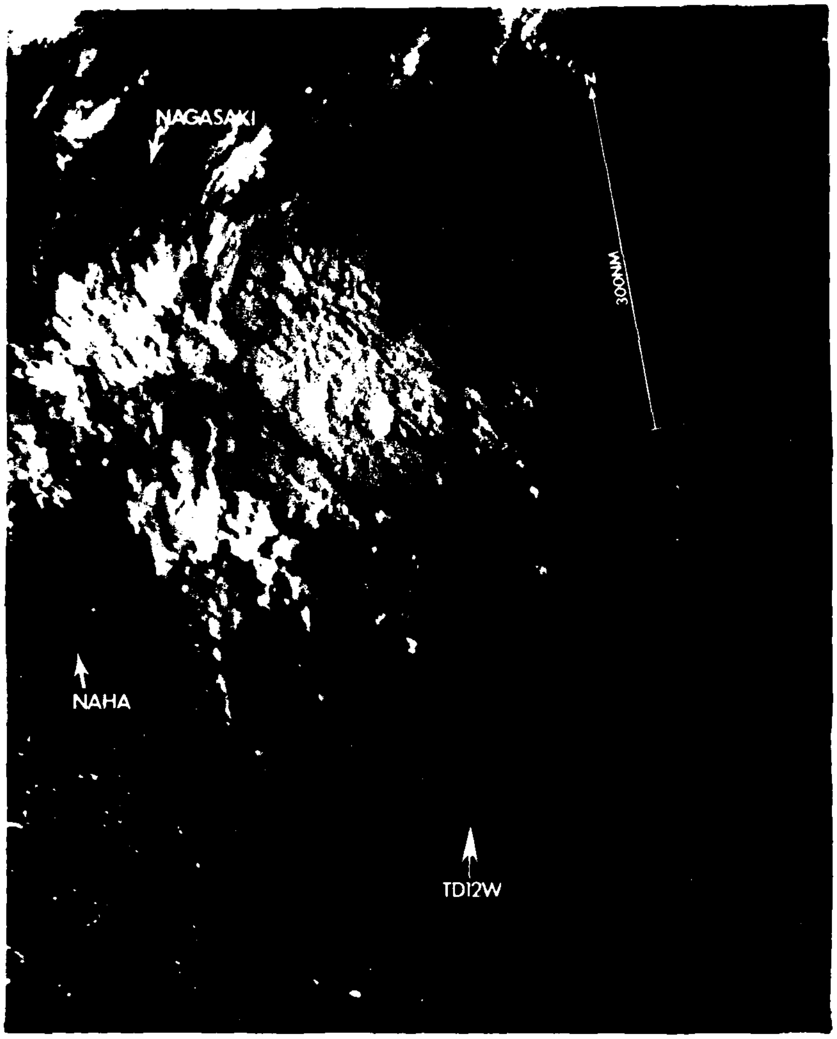
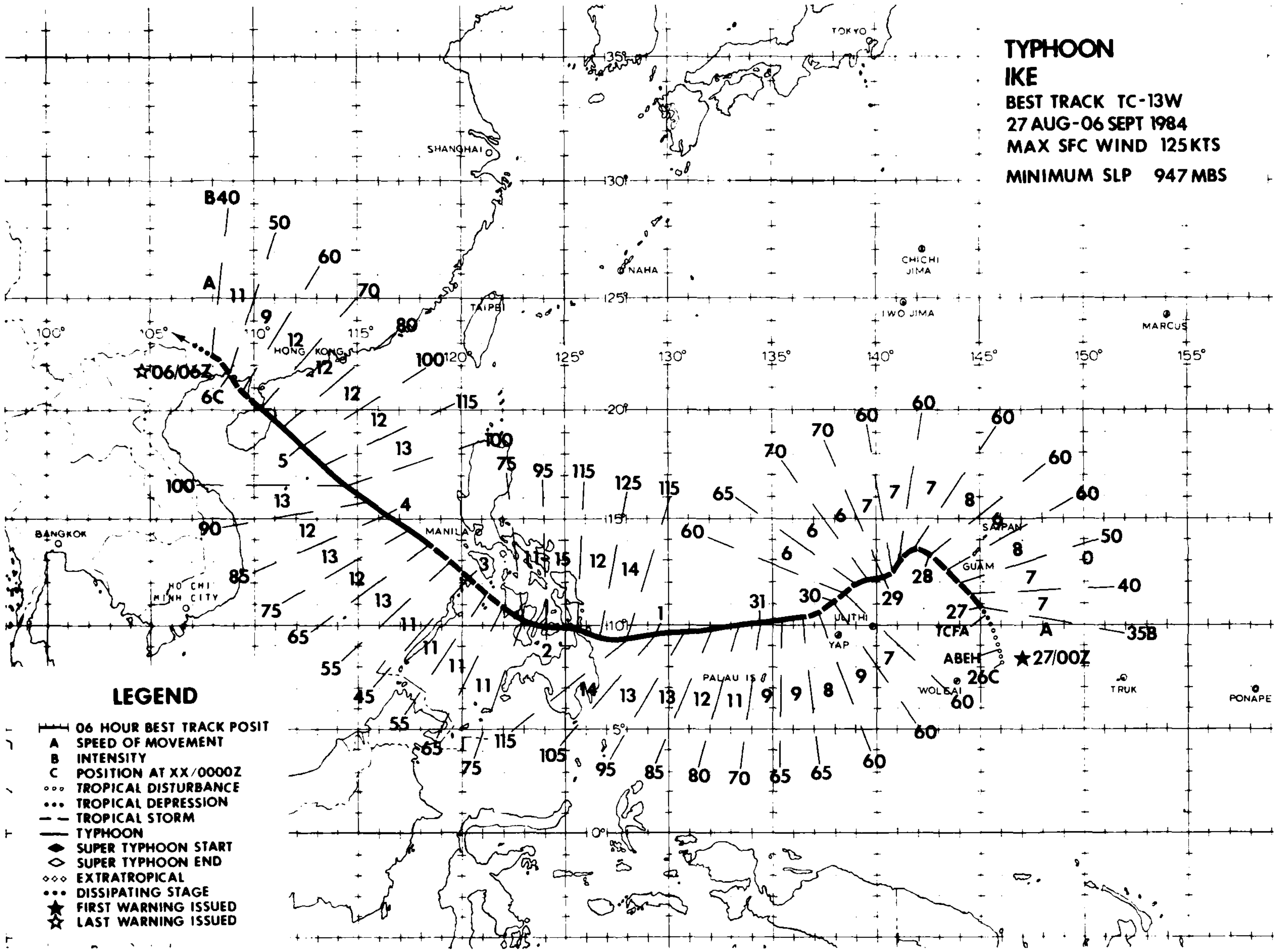


Figure 3-12-1. Exposed low-level circulation of Tropical Depression 12W. The convection which was colocated with the low-level circulation 24 hours earlier is now displaced to the north (242219Z August NOAA visual imagery).

unlikely, the final warning was issued at 0000Z on the 25th.

There were a total of four aircraft reconnaissance missions flown into this system, but only two could fix a center, and both of these had large meteorological and navigational errors. The maximum surface or 1500 ft (457 m) winds found within 200 nm (320 km) of the center were 20 kt (10 m/s). The minumum sea-level pressure found by aircraft was 995 mb at 240708Z which could support 35 kt (18 m/s) winds according to Atkinson and Holliday (1977). However, no such winds were observed with Tropical Depression 12W.

The exposed low-level circulation, completely void of convection, was tracked northwest after the final warning was issued with 15 to 20 kt (8 to 10 m/s) winds and pressures near 1000 mb being reported. This circulation crossed the Ryukyu Islands near Okinawa before merging with a weak mid-latitude front in the northern East China Sea late on 26 August.


TYPHOON
IKE
BEST TRACK TC-13W
27 AUG-06 SEPT 1984
MAX SFC WIND 125 KTS
MINIMUM SLP 947 MBS
LEGEND
06 HOUR BEST TRACK POSIT
A SPEED OF MOVEMENT
B INTENSITY
C POSITION AT XX/0000Z
TROPICAL DISTURBANCE
TROPICAL DEPRESSION
TROPICAL STORM
TYPHOON
SUPER TYPHOON START
SUPER TYPHOON END
EXTRATROPICAL
DISSIPATING STAGE
FIRST WARNING ISSUED
LAST WARNING ISSUED
TOKYO
SHANGHAI
NAHA
TAIPEI
HONG KONG
MANILA
BANGKOK
HO CHI MINH CITY
CHICHI JIMA
IWO JIMA
MARCUS
SAIPAN
GUAM
ULITHI
YAP
PALAU IS
WOLEAI
TRUK
PONAPE
TCFA
ABEH
★27/00Z
☆06/06Z

TYPHOON IKE (13W)

The deadliest typhoon to strike the Philippines this century began innocently enough as a weak disturbance on the eastern end of the monsoon trough. After passing Guam as a developing tropical storm, Ike turned to the west-southwest and gradually intensified. Four days later, Ike attained an intensity of 125 kt (64 m/s) and crossed the central Philippines causing extensive damage and over 2000 deaths. After wrecking havoc on the Philippines, a weakened Ike moved into the South China Sea where it reintensified to 115 kt (59 m/s) before making landfall and finally dissipating over mainland China.

As early as 21 August, a weak surface circulation was being analyzed southeast of Guam on the eastern extension of the monsoon trough. From the 21st through the 25th, various Trust Territory of the Pacific Islands reporting stations and ship observations indicated that a weak 1009 mb low persisted in this area. The lack of development of this circulation during this period was attributed to the strong winds aloft from the same anticyclone that sheared Tropical Depression 12W.

Late on the 25th the upper-level shearing began to decrease. This resulted in a rapid increase in the convection over the low-level circulation center. By 260000Z the disturbance, which was to develop into Ike, began to show continuity. Synoptic data at 261200Z indicated the disturbance was intensifying with 20 to 35 kt (10 to 18 m/s) winds being reported on the southern periphery of the circulation center. The MSLP of the disturbance was estimated to be near 1006 mb.

At 2100Z on the 26th, a TCFA was issued based on the earlier mentioned synoptic reports and satellite imagery which showed rapid development of a compact circulation (Figure 3-13-1). Due to the persistent improvement in organization and the proximity of the disturbance to Guam, the first warning on Ike was issued a few hours later at 270000Z.

The initial forecast track called for Ike to move to the northwest. This forecast was based on persistence and the One-Way Interactive Tropical Cyclone Model (OTCM), the best forecast aid currently available to the Joint Typhoon Warning Center. Based on the location of the system and the forecast track, Guam was placed in Condition of Readiness III at 270530Z. This was the first time since 1 December 1982 that Guam had been in other than Condition of Readiness IV. (At that time Typhoon Pamela was approaching from the east.)

The first aircraft reconnaissance flight into Ike fixed the center at 270510Z approximately 120 nm (222 km) south of Guam with an MSLP of 997 mb and estimated the maximum surface winds at 35 kt (18 m/s). Ike continued moving to the northwest at a speed of 7 to 9 kt (13 to 17 km/hr) during the next 24 hours and intensified. The storm remained compact as it passed 90 nm (167 km) southwest of Guam. At its closest point of approach to Guam, Ike supported winds of 50 to 60 kt (26 to 31 m/s) but due to the compact circulation, Guam suffered no ill effects from the storm. The Naval Oceanography Command Center (NAVOCEANCOMCEN) on Nimitz Hill recorded only 15 kt (8 m/s) sustained winds with a peak gust to 21 kt (11 m/s) during Ike's passage. Guam returned to Condition of Readiness IV at 272130Z based on the 271800Z warning position and forecast track.

After passing to the southwest of Guam, Ike continued tracking to the northwest for the next 12 hours. At approximately 0600Z on the 28th, Ike reached the northern most latitude it would attain in the Philippine Sea. At that time Ike was located 160 nm (296 km) due west of Guam. For the next four days Ike would track towards the Philippines on a west-southwest course.

Figure 3-13-1. Early morning picture of Ike at the time the TCFA was issued. A developing upper-level anticyclone is providing good outflow channels to the south and west (262131Z August NOAA visual imagery).

This change in track was due to the effects of the subtropical ridge south of Japan. From the 26th to the 28th, this ridge was orientated from east to west. However, as Tropical Storm June (which developed over the western Philippine Sea on 28 August) moved westward, the ridge built south in June's wake and took on a more north-south orientation. This forced Ike on a generally west-southwest course until it neared the central Philippines. Between 271800Z and 281800Z, Ike did not increase in intensity due to strong shearing of the convection from the north.

Late on the 28th, the shearing decreased slightly which allowed Ike to intensify to typhoon strength. During this intensification the Atkinson and Holliday (1977) pressure-wind relationship did not hold. For example, at 282341Z aircraft reconnaissance reported surface and flight level winds of 75 kt (39 m/s), yet the MSLP was only 991 mb. This would normally be expected to support winds of 45 kt (23 m/s), some 30 kt (15 m/s) less than what was being observed. After moving almost due west for 12 hours, Ike again turned to the southwest. During this time Ike weakened to below typhoon force due to the persistent strong shearing aloft. However, this weakening was to be temporary.

As Ike turned more to the west on the 30th, the upper-level anticyclone over Ike redeveloped and the weakening trend ceased. By 301200Z Ike had regained typhoon intensity. During this second intensification period the pressure-wind relationships were in better agreement. At 302310Z aircraft reconnaissance found the MSLP had decreased to 971 mb and reported 700 mb flight level winds of 65 kt (33 m/s). This was in much better agreement with the 70 kt (36 m/s) winds expected by Atkinson and Holliday (1977). During this second intensification, Ike's circulation became larger - more typical of a WESTPAC typhoon.

For the next two days Ike tracked toward the central Philippines at an average speed of 12 kt (22 km/hr) and doubled in intensity. Figure 3-13-2 shows Ike as it neared the Philippines. On the 1st of September just prior to hitting the Philippines, the last aircraft reconnaissance flight was made. The lowest MSLP found was 947 mb at 010845Z and 700 mb flight level winds of 117 kt (60 m/s) were measured in the eyewall of a 25 nm (46 km) circular eye. The maximum surface winds were estimated at 120 to 130 kt (62 to 67 m/s).

For the next 30 hours Ike cut a path of death and destruction across the central Philippine Islands that is unequaled in recent history (Figure 3-13-3). In the wake of its path, Ike left a reported 1026 people dead, with 1147 people missing and presumed dead. Published figures for the number of people left homeless in the central Philippines range from 200,000 to 480,000. The worst hit region was the Surigao del Norte Province of Northern Mindanao where approximately 1000 people died (Figure 3-13-4).

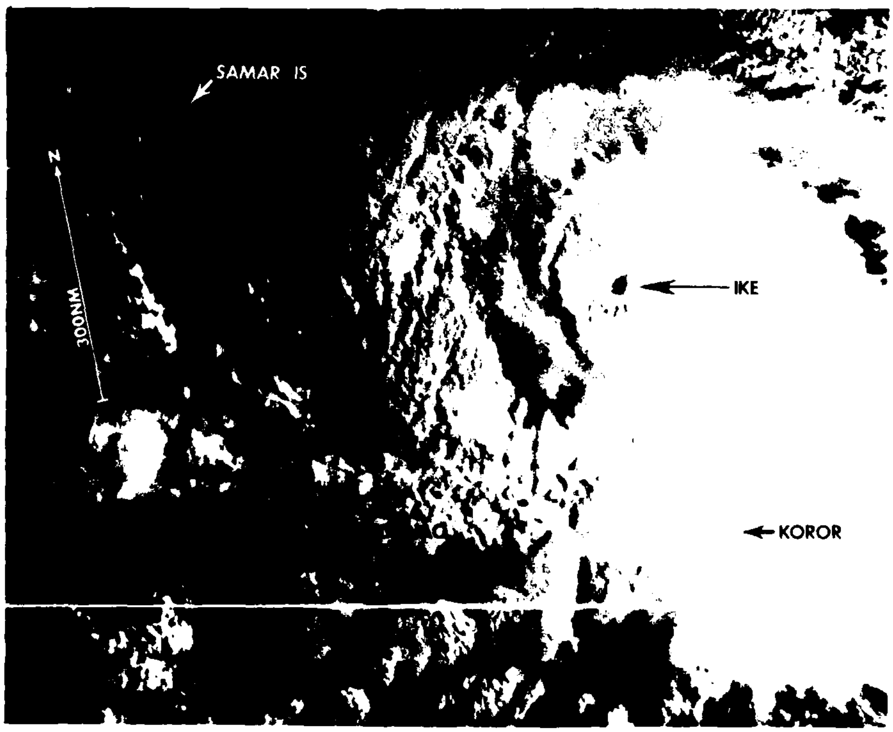


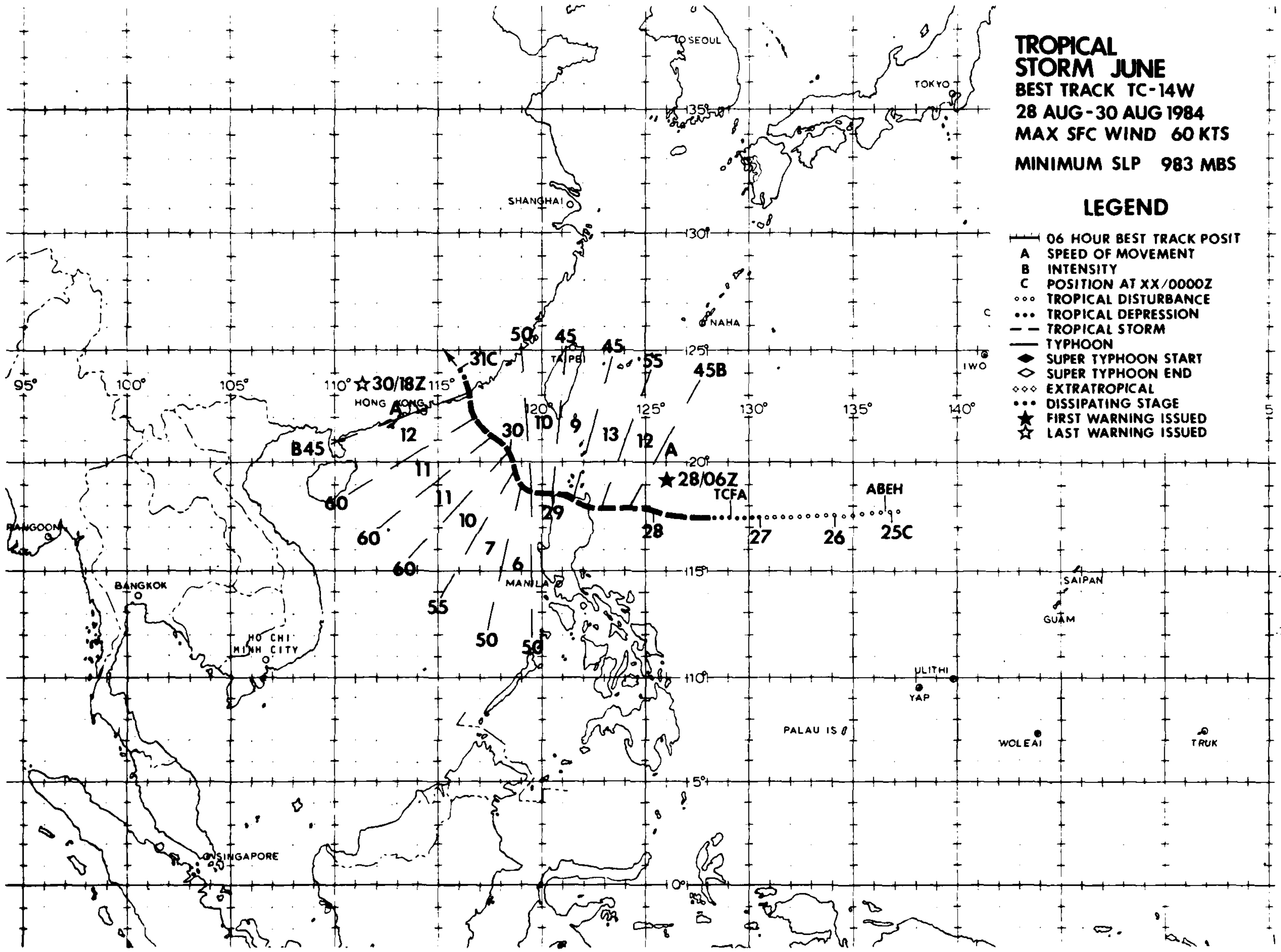
Figure 3-13-2. Typhoon Ike intensifying as it nears the Philippines. At this time Ike was supporting winds of about 105 kt (54 m/s) (312252Z August NOAA visual imagery).

Ike tracked to the west-northwest and then to the northwest at an average speed of 11 kt (20 km/hr) as it crossed the Philippines and weakened. At 0000Z on the 3rd of September Ike had weakened to 45 kt (23 m/s). Ike quickly reintensified as it moved into the South China Sea attaining typhoon intensity by 031200Z. Aircraft reconnaissance penetrating the 30 nm (56 km) wide eye at 030843Z found 65 kt (33 m/s) winds at the surface and 68 kt (35 m/s) winds at 700 mb. Ike continued to track steadily to the northwest at 12 to 13 kt (22 to 24 km/hr) reaching an intensity of 115 kt (59 m/s) at 041800Z. Ike gradually lost intensity from this point on, due to the proximity of land restricting the inflow, and shearing from a trough passing to the north.

Ike transited across Hainan Island on 5 September still packing winds of 70 to 80 kt (36 to 41 m/s). Shortly after 0000Z on the 6th, Ike crossed the coast of mainland China, as a tropical storm, approximately 60 nm (111 km) south-southeast of Nan-Ning (WMO 59431). News reports indicate Ike was responsible for at least 13 deaths in China. Extensive flooding and crop damage were also reported as Ike moved inland and dissipated.

Figure 3-13-3. Ike as it crossed the central Philippines. At this time Ike was supporting winds of about 90 kt (46 m/s) (020141Z September DMSP visual imagery).

Figure 3-13-4. Aerial reconnaissance photo of a town in Northern Mindanao showing some of the damage caused by Typhoon Ike. (Photo provided by CDR M. McCallister, Naval Oceanography Command Facility, Cubi Point).


TROPICAL STORM JUNE
BEST TRACK TC-14W
28 AUG-30 AUG 1984
MAX SFC WIND 60 KTS
MINIMUM SLP 983 MBS
LEGEND
06 HOUR BEST TRACK POSIT
A SPEED OF MOVEMENT
B INTENSITY
C POSITION AT XX/0000Z
TROPICAL DISTURBANCE
TROPICAL DEPRESSION
TROPICAL STORM
TYPHOON
SUPER TYPHOON START
SUPER TYPHOON END
EXTRATROPICAL
DISSIPATING STAGE
FIRST WARNING ISSUED
LAST WARNING ISSUED
SEOUL
TOKYO
SHANGHAI
NAHA
IWO
TAIPEI
HONG KONG
MANILA
BANGKOK
HO CHI MINH CITY
RANGOON
SINGAPORE
SAIPAN
GUAM
ULITHI
YAP
PALAU IS
WOLEAI
TRUK
ABEH
TCFA
★28/06Z
☆30/18Z
25C
26
27
28
29
30
31C
45B
B45

Tropical Storm June, the last of seven significant tropical cyclones to develop during August, originated in the monsoon trough like most of the other storms before it. June would also be typical of several other storms during the month, in that the most difficult part of warning on the system would be in locating the actual surface center.

Even as the final warning was being issued on the exposed low-level circulation of Tropical Depression 12W, satellite imagery indicated a large area of convection persisted further south over the active monsoon trough (Figure 3-14-1). At 1200Z on the 25th of August, synoptic data indicated a closed 1000 mb circulation had formed in the trough. During the next two days this circulation drifted westward as the associated convection tried to consolidate. Strong upper-level shearing, from the same anticyclone which sheared Tropical Depression 12W, inhibited development on the 25th and 26th. But early on the 27th, an upper-level anticyclone began to form over the disturbance making conditions more favorable for development. Although synoptic data clearly indicated a surface circulation was present during this time, the low-level center was not consistently locatable on satellite imagery within the broad area of convection. This problem would plague JTWC throughout the life of Tropical Storm June.

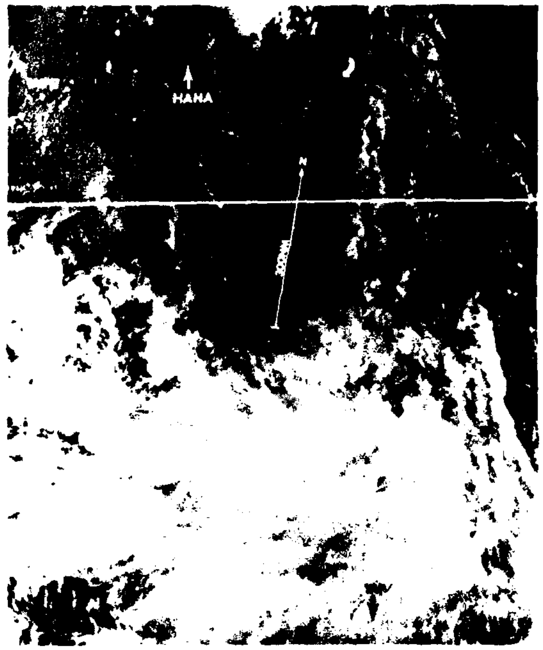


Figure 3-14-1. Active area of convection in the northern Philippine Sea associated with the southwest monsoon which would later develop into Tropical Storm June. Note the exposed low-level circulation further north which is the remnants of Tropical Depression 12W (250630Z August NOAA visual imagery).

The first aircraft reconnaissance mission into the disturbance at 270651Z found a closed 30 kt (15 m/s) circulation with a light and variable wind center 50 nm (93 km) in diameter. Based on this information and indications from satellite imagery that the convection was becoming more organized, a TCFA was issued at 270800Z. As typical with most monsoon disturbances, the strongest winds were observed south of the circulation center and associated with the southwest monsoon.

During the following 18 hours, synoptic data indicated the disturbance continued to intensify. However, the convection failed to show the expected increase in organization. During much of this time satellite imagery actually indicated multiple circulation centers were present! Although JTWC wanted to go to warning status on this disturbance as early as 271200Z, the inability to accurately position the surface center made this impossible. The area of gale force winds, however, were covered in the NAVOCEANCOMCEN Guam, extratropical wind warning bulletin (WWPN PGFW).

Figure 3-14-2. The developing Tropical Storm June east of the Philippines. At this time June was consolidating about a single circulation center (280734Z August NOAA visual imagery).

Between 280000Z and 280600Z the disturbance finally consolidated into a single circulation center (Figure 3-14-2). Aircraft and satellite fixes now began to consistently agree on the location of that center. This prompted the issuance of the first warning on June as a tropical storm at 280600Z.

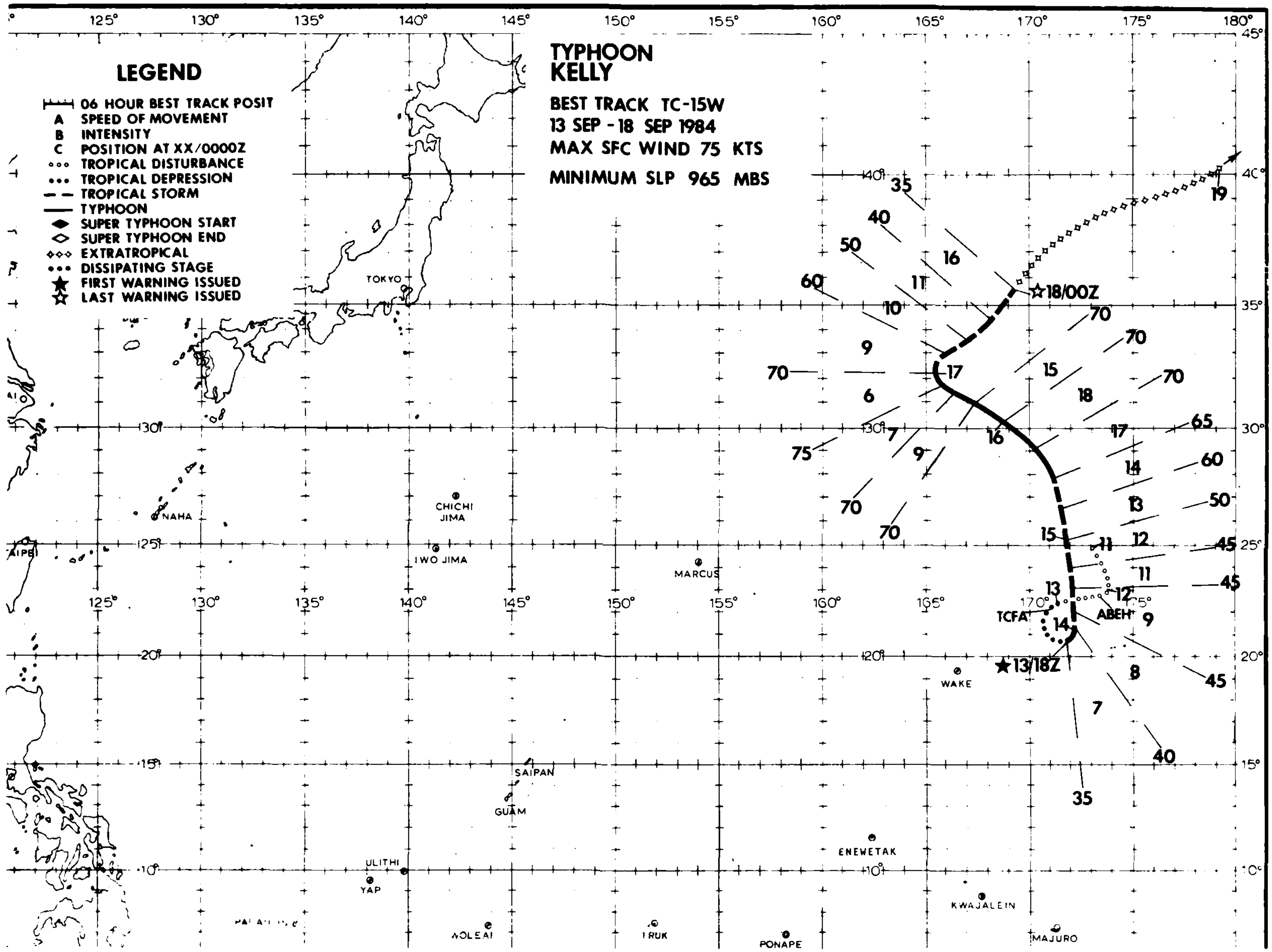
At the time of the first warning, Tropical Storm June was located 110 nm (204 km) east of Luzon. June was a broad circulation with the strongest winds in a band 60 to 150 nm (111 to 278 km) from the center. During the next 12 hours June headed west steered by the flow along the south side of a mid to low-level subtropical ridge. The storm made landfall on the east coast of northern Luzon at about 281500Z.

After landfall synoptic data indicated the surface circulation of June apparently tracked to the west-northwest following the low-level terrain over northern Luzon and re-emerged on the northwest coast at approximately 290000Z. However, the mid-level circulation and nearly all of the convection continued to move almost due west. Since the passage over Luzon occurred at night when only infrared imagery was available, accurate positioning of the low-level center from satellite imagery was impossible.

Figure 3-14-3. Tropical Storm June in the northern South China Sea. The broad surface circulation is located north of the convection. This is one of the few times that satellite imagery would be able to accurately fix the low-level circulation of June as it transited the South China Sea (292340Z NOAA visual imagery).

As June emerged in the northern South China Sea a mid-latitude trough moved across eastern China and weakened the subtropical ridge. This allowed June to turn to the northwest. June made landfall at approximately 301700Z on the coast of mainland China 130 nm (241 km) east of Hong Kong (WMO 45005). Although June did intensify to 60 kt (31 m/s) as it transitted the northern South China Sea, the storm remained poorly organized (Figure 3-14-3). During this time aircraft and radar were the only accurate and consistent means of locating the circulation center.

Tropical Storm June was the first named tropical cyclone of the 1984 season to directly strike the Philippines. Heavy rains from the combination of June and the southwest monsoon caused extensive flooding throughout much of Luzon, particularly along the west coast and in river valleys. At least 67 deaths were attributed to the storm. The deaths resulted primarily from heavy rains, flooding and the accompanying landslides. In addition to extensive damage to crops and vegetation, over 25,000 families lost their homes. However, despite the considerable damage caused by June, it was relatively minor compared to the death and destruction Typhoon Ike brought to the central Philippines only four days later.


TYPHOON
KELLY
BEST TRACK TC-15W
13 SEP - 18 SEP 1984
MAX SFC WIND 75 KTS
MINIMUM SLP 965 MBS
LEGEND
06 HOUR BEST TRACK POSIT
A SPEED OF MOVEMENT
B INTENSITY
C POSITION AT XX/0000Z
TROPICAL DISTURBANCE
TROPICAL DEPRESSION
TROPICAL STORM
TYPHOON
SUPER TYPHOON START
SUPER TYPHOON END
EXTRATROPICAL
DISSIPATING STAGE
FIRST WARNING ISSUED
LAST WARNING ISSUED
18/00Z
13/18Z
TCFA
ABEH
TOKYO
NAHA
CHICHI JIMA
IWO JIMA
MARCUS
WAKE
SAIPAN
GUAM
ULITHI
YAP
ENEWETAK
KWAJALEIN
MAJURO
PONAPE
TRUK
WOLEAI

Typhoon Kelly was quite representative of the first half of the 1984 season which was characterized by numerous high latitude, fast-moving systems. This typhoon developed at the southern end of a shear line and displayed some erratic movement during its formative stages before accelerating to the north-northwest towards a mid-level cut-off low. During the last phase of its life, Kelly recurved very sharply to the northeast and transitioned into an extratropical system.

During the first week of September, a strong frontal system moved across the North Pacific Ocean and left in its wake a quasi-stationary shear line extending between 20N 170E and 35N 180E. On 11 September the southern portion of the shear line became detached and began to take on tropical characteristics.

During the next two days the disturbance slowly developed as the associated convection increased in organization. At 0000Z on the 13th, an exposed low-level circulation was observed on satellite imagery west-northwest of the main convection. Dvorak intensity analysis of the 130000Z imagery estimated that 30 kt (15 m/s) surface winds were present near the center. Sparse synoptic data indicated a 20 to 25 kt (10 to 13 m/s) circulation was present. Based on this information, a TCFA was issued at 130435Z and an aircraft investigative mission was requested for the following morning. Throughout the evening the system continued to develop with the convection showing a considerable increase in organization. This prompted the issuance of the first warning at 131800Z. While this was occurring in the south, a mid-level cold core low was developing further north on the northern remnants of the shear line. This cut-off low and the mid-latitude westerlies just north of it would be the principal steering mechanisms for Kelly.

As long as Kelly stayed below tropical storm strength it moved slowly. Satellite fixes on the 13th indicated Kelly moved in a cyclonic loop about its point of origin. However, after it became a named storm, Kelly accelerated to the north and eventually to the northwest as it was caught in the southerlies between the mid-Pacific high and the inflow pattern about the cut-off low. Because of its relatively high latitude, Kelly entrained cold air into its circulation almost from the start, and was slow to intensify. By 141800Z there was a noticeable "dry slot" forming and the storm took on a north-south orientation (Figure 3-15-1).

As Kelly approached the cold low (Figure 3-15-2) it slowed and reached maximum intensity. Then suddenly, under the influence of the mid-latitude westerlies just to the north, it abruptly turned and accelerated to the northeast. Although JTWC forecasts indicated recurvature to the northeast would occur, it was not forecast to *begin* until Kelly reached 35N. It now appears the westerlies were located further south than Figure 3-15-2 indicates. Kelly

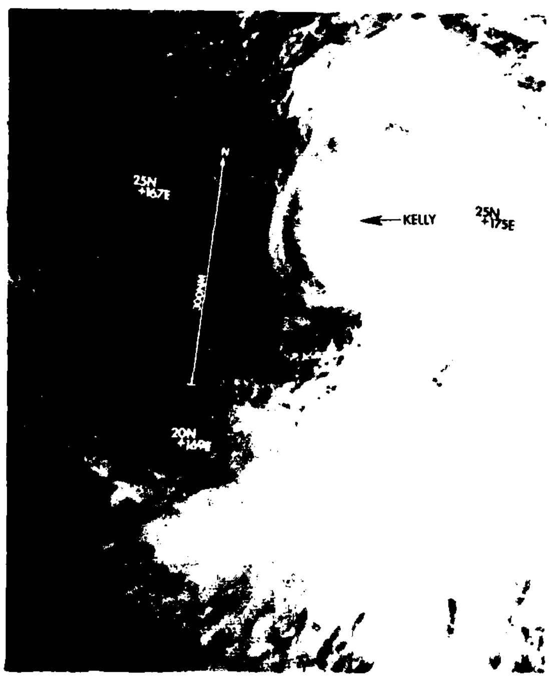


Figure 3-15-1. Kelly as an intensifying tropical storm. Kelly was accelerating to the north-northwest at this time (142259Z September DMSP visual imagery).

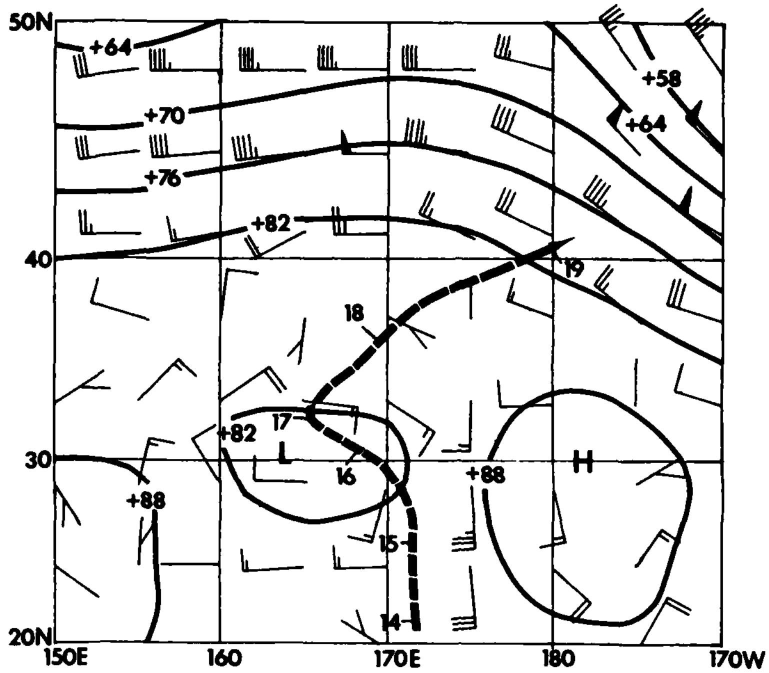
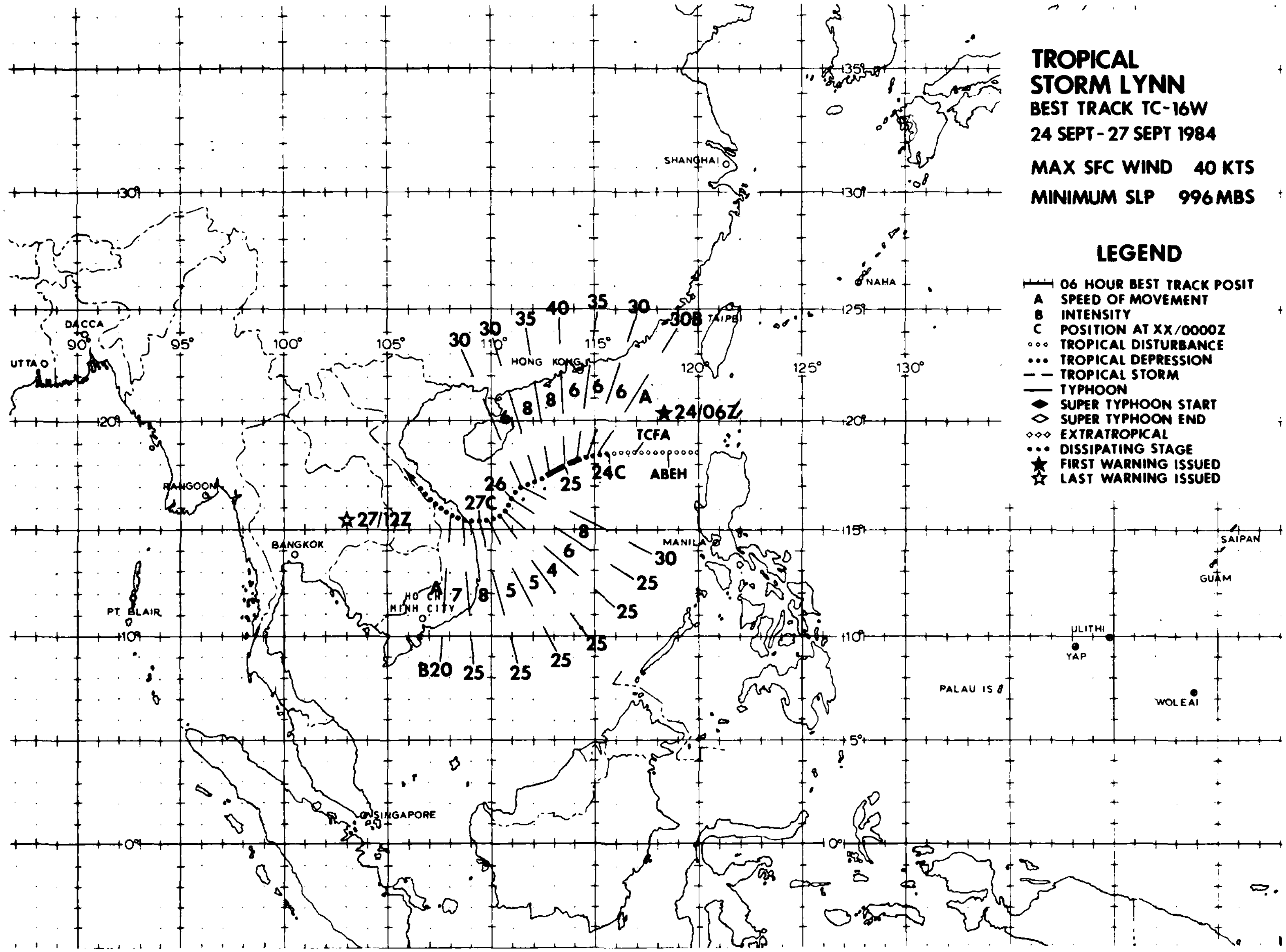


Figure 3-15-2. Mid-level tropospheric flow representative of the conditions present during the time Kelly was accelerating to the north and at the time of recurvature to the northeast. The simplified track of Typhoon Kelly is the dashed line (160000Z September 500 mb FNOC NOGAPS analysis).

weakened very rapidly after recurvature as the convection began to be sheared. By 171200Z the storm had started to loose its tropical characteristics.

In this phase, Kelly began to demonstrate intensity anomalies frequently observed in storms becoming extratropical. The low central pressures observed did not correspond well with the relatively weak winds found by aircraft reconnaissance. On the other hand, since the central convection had nearly disappeared, the Dvorak intensity model estimated winds significantly lower than what was observed by aircraft. By 180000Z Kelly had completed its extra-tropical transition and the final warning was issued. The remnants of Kelly continued to the northeast and were locatable on satellite imagery until the 21st. By then the system was east of the International Dateline and moving into the Gulf of Alaska.


TROPICAL
STORM LYNN
BEST TRACK TC-16W
24 SEPT - 27 SEPT 1984
MAX SFC WIND 40 KTS
MINIMUM SLP 996 MBS
LEGEND
06 HOUR BEST TRACK POSIT
A SPEED OF MOVEMENT
B INTENSITY
C POSITION AT XX/0000Z
TROPICAL DISTURBANCE
TROPICAL DEPRESSION
TROPICAL STORM
TYPHOON
SUPER TYPHOON START
SUPER TYPHOON END
EXTRATROPICAL
DISSIPATING STAGE
FIRST WARNING ISSUED
LAST WARNING ISSUED
SHANGHAI
NAHA
TAIPEI
HONG KONG
MANILA
BANGKOK
HO CHI MINH CITY
RANGOON
DACCA
UTTA
PT BLAIR
SINGAPORE
SAIPAN
GUAM
ULITHI
YAP
WOLEAI
PALAU IS
24/06Z
27/12Z
TCFA
ABEH
24C
25
26
27C
30B
B20

After Typhoon Ike moved inland over China early on 6 September, strong surface ridging from the subtropical ridge kept easterlies across much of the tropical Northwest Pacific. By mid-September, the ridging began to give way to the southwest monsoon. This helped set the stage for the development of Tropical Storm Lynn.

The disturbance that would eventually become Lynn was first noticed as an area of poorly organized convection near Guam on 19 September. During the following three days the area of convection moved west across the northern Philippine Sea with little development noted. The convection was apparently associated with a westward moving TUTT cell. As the TUTT cell weakened east of Luzon, divergence from an upper-level anticyclone north of Guam, which was ridging westward, maintained the convection. By the 22nd, a second upper-level anticyclone had developed just northeast of Luzon near the disturbance and the convection began to increase. During this entire time, surface synoptic data indicated only convergent easterly trades were present beneath the convection.

At 230000Z, the convection entered the South China Sea. At the same time, a lee side low-level cyclonic circulation formed in the monsoon trough just west of Luzon, apparently the result of persistent easterly flow across the mountainous terrain of northern Luzon. This provided the low-level circulation which would accelerate the development of Tropical Storm Lynn.

During the next several hours the disturbance rapidly consolidated. Ship reports indicated the surface circulation had 10 to 20 kt (5 to 10 m/s) winds with an MSLP estimated at 1003 mb. The associated convection showed a significant increase in development as it tried to organize near the low-level circulation. In addition, a cut-off low over southern China was enhancing the outflow from the anticyclone northeast of Luzon. Based on this collective information, the Significant Tropical Weather Advisory (ABEH PGTW) was reissued at 231000Z to include this disturbance as a suspect area. The potential for significant tropical cyclone development was assissed as "fair".

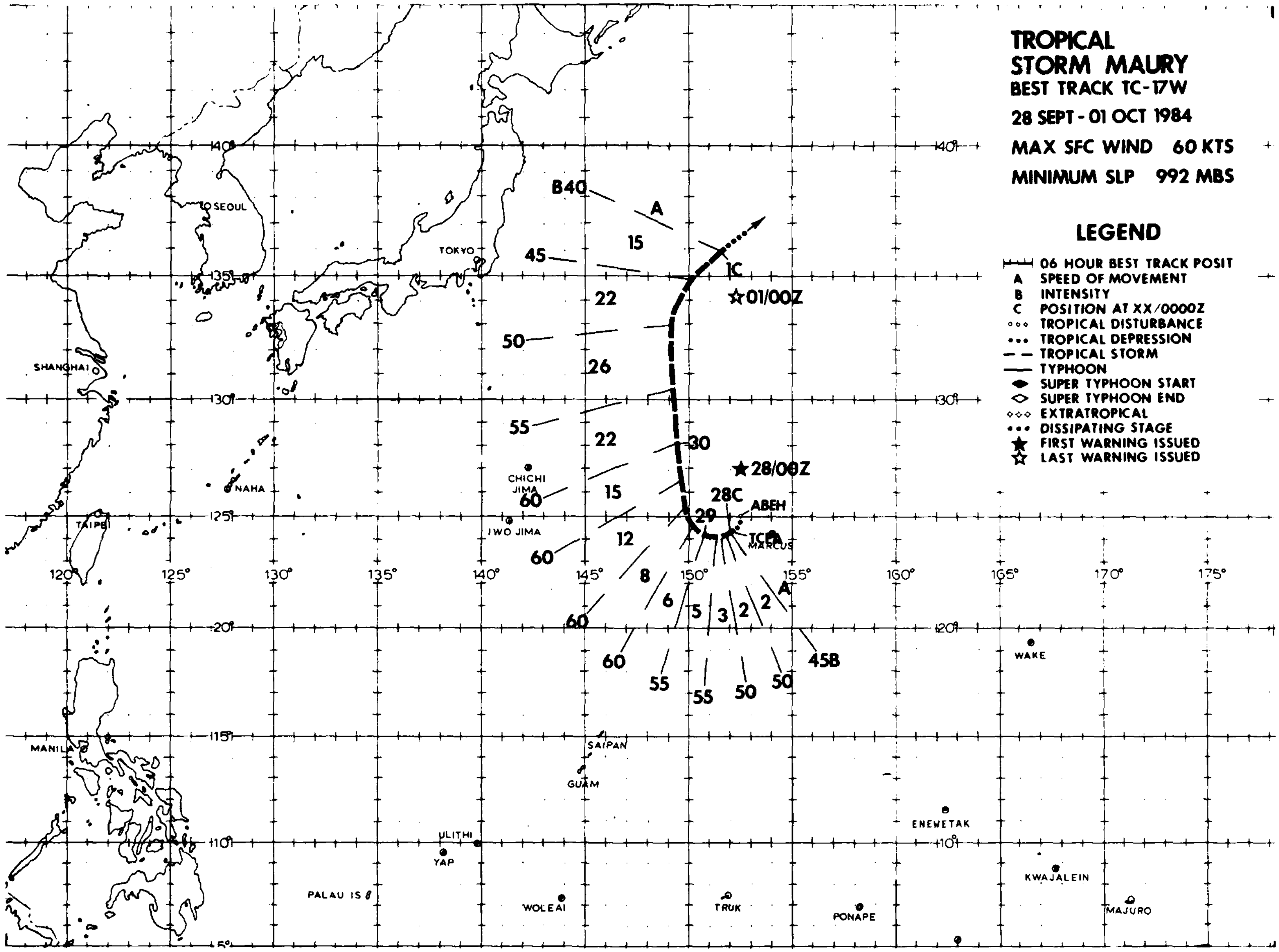
During the next nine hours, the tropical disturbance continued to show signs of increased organization on satellite imagery. At 231800Z, imagery indicated that a central area of intense convection had formed. Synoptic data showed the disturbance now had winds of 20 to 30 kt (10 to 15 m/s). Based on these developments a TCFA was issued at 231900Z.

The first warning on Lynn as a tropical depression was issued at 240600Z when satellite imagery indicated that the convection was moving over the low-level circulation center and intensifying. The first few warnings forecast Lynn to slowly intensify and move to the west-northwest. This forecast track was based on guidance from the One-Way Interactive Tropical Cyclone Model (OTCM). During the next 18 hours Lynn did intensify some, reaching tropical storm strength at 241800Z and peaking at 40 kt (21 m/s) at 250000Z. After that point in time, since Lynn had been moving slowly west-southwest away from the upper-level anticyclone northeast of Luzon, it lost its upper-level outflow and entered a shearing environment. This resulted in a displacement of the convection to the north of the low-level circulation center and the start of a weakening trend (Figure 3-16-1). In addition to the shearing, the enhancement of the anticyclonic outflow by the cut-off low over southern China had now ceased as the low dissipated at about 250000Z.

At 0600Z on the 25th, it was apparent that Lynn had become a sheared system and that no further intensification would likely occur. The closest convection was located more than 120 nm (222 km) to the northeast. Lynn was now expected to follow a west-southwest track along the northern periphery of the low-level monsoon trough until it dissipated over central Vietnam. Tropical Storm Lynn posed no further forecast problems after that except for the difficulty in positioning the exposed low-level circulation center at night.

During the twenty-four hours prior to landfall, Lynn did experience a flare-up of its convection. Synoptic data at 0000Z on the 27th showed that the upper-level anticyclone had reformed near Hainan Island and that the flow over Lynn had become weak but diffluent. Also possibly contributing to this convective flare-up prior to landfall was convergence of the low-level flow and orographic lifting; both caused by the mountainous terrain inland of the Vietnam coast. After making landfall 50 nm (93 km) southeast of Da Nang (WMO 48855) Lynn turned northwest dissipating along the Vietnam/Laos border after 271800Z. There were no reports of damage or injuries from Tropical Storm Lynn.

Figure 3-16-1. Tropical Storm Lynn being sheared. The exposed low-level circulation is southwest of the main convection (250223Z September DMSP visual imagery).


TROPICAL
STORM MAURY
BEST TRACK TC-17W
28 SEPT - 01 OCT 1984
MAX SFC WIND 60 KTS
MINIMUM SLP 992 MBS
LEGEND
06 HOUR BEST TRACK POSIT
A SPEED OF MOVEMENT
B INTENSITY
C POSITION AT XX/0000Z
TROPICAL DISTURBANCE
TROPICAL DEPRESSION
TROPICAL STORM
TYPHOON
SUPER TYPHOON START
SUPER TYPHOON END
EXTRATROPICAL
DISSIPATING STAGE
FIRST WARNING ISSUED
LAST WARNING ISSUED
☆01/00Z
★28/00Z
28C
ABEH
TCFA
MARCUS
SEOUL
TOKYO
SHANGHAI
NAHA
TAIPEI
CHICHI JIMA
IWO JIMA
SAIPAN
GUAM
MANILA
ULITHI
YAP
PALAU IS
WOLEAI
TRUK
PONAPE
ENEWETAK
KWAJALEIN
MAJURO
WAKE

TROPICAL STORM MAURY (17W)

During a four week period extending from the last week of September until the middle of October, a large amplitude long wave trough persisted in the western North Pacific. This trough weakened the subtropical ridge and displaced it to the east of its climatological position. As a result, tropical cyclones developing in the western North Pacific would accelerate to the north and recurve almost as soon as they developed. Tropical Storm Maury was the first of five storms to develop in the western North Pacific during this period. As would be the case with the four storms after it, Maury failed to show any significant westward movement prior to accelerating to the north and recurving.

Tropical Storm Maury formed near Marcus Island (Minami Tori-Shima (WMO 47991)) at approximately the same time that Tropical Storm Nina was developing some 700 nm (1296 km) to the west-southwest. Nina's proximity would ultimately have a significant influence on Maury's future.

Maury was originally detected early on 27 September as an area of developing convection on the northeast extension of the monsoon trough. Initially the trough was linked to the trailing end of a mid-latitude front and this may have supplied some low-level vorticity which aided in the rapid development of the system.

The disturbance was first discussed on the 270600Z Significant Tropical Weather Advisory (ABEH PGTW) as one of several weak circulations embedded in the trough. During the next 10 hours it became evident that only two circulations would dominate. Consequently the ABEH was reissued at 271600Z to indicate this concern. These two circulations would soon develop into Maury and Nina respectively.

The disturbance continued to develop at a rapid pace; much faster than JTWC anticipated. Dvorak intensity analysis performed on the 271800Z imagery indicated that 25 kt (13 m/s) winds were present. The imagery over the area two hours later showed that a well-defined compact low-level circulation center had developed. Consequently, a TCFA was issued at 272300Z. At 272341Z, Dvorak analysis of Figure 3-17-1 indicated that 35 kt (18 m/s) winds were now present in this rapidly developing system. Based on the satellite intensity analysis, JTWC issued the first warning on Maury as a 35 kt (18 m/s) tropical storm at 280000Z. Synoptic data during this period was unable to shed any light on the true intensity of Maury.

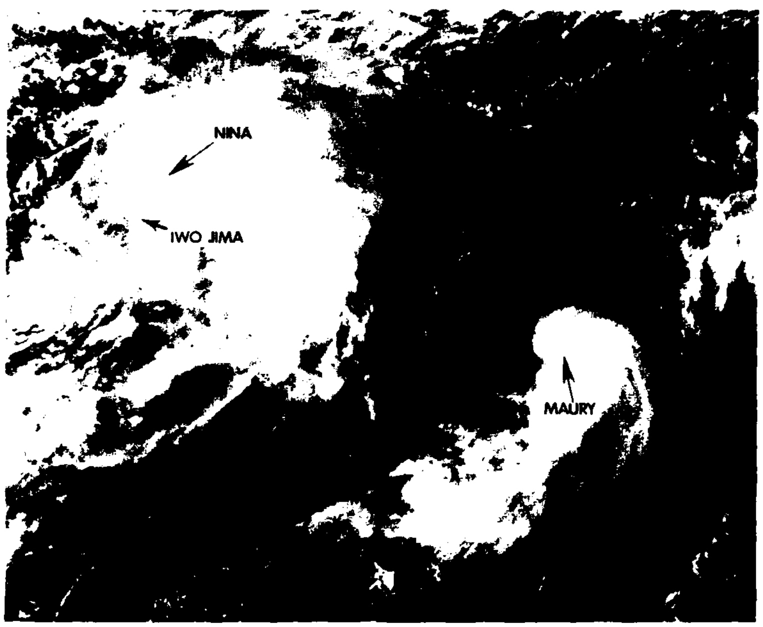


Figure 3-17-1. A compact Tropical Storm Maury just prior to issuance of the first warning. Dvorak intensity analysis of this imagery indicated that 35 kt (18 m/s) surface winds were present. This prompted JTWC to warn on this storm. The much larger Tropical Storm Nina is developing to the west (272341Z September DMSP visual imagery).

The first aircraft reconnaissance, conducted early on the 28th, quickly found the well-defined circulation center at 280303Z and reported that Maury was stronger than expected. Maximum surface winds of 50 kt (26 m/s) were found both southwest and northeast of the center. Consequently, the 280000Z warning was ammended to reflect these higher wind speeds.

During the next 30 hours, Maury moved slowly west, then northwest and further intensified reaching its peak intensity of 60 kt (31 m/s) at 290600Z. From now on the movement and intensity of Maury would be governed primarily by the much larger Tropical Storm Nina.

The upper-level anticyclone which was located just east of Nina exerted considerable pressure on Maury's convection from the start. The large anticyclone brought strong northerly upper-level winds over Mau which displaced the convection to the south. As a result, Maury's low - level circulation center was consistently located near the northwest edge of the convection (Figure 3-17-1). This strong wind shear prevented Maury from ever attaining typhoon strength.

In addition to affecting Maury's intensity, these strong winds aloft may also have been responsible for preventing Maury from turning to the north on 27 and 28 September. It is likely that the outflow from the anticyclone descended and generated a weak mid-level induced ridge north of Maury which temporarily prevented any significant movement of the storm until Nina had moved further north.

On 29 September, Nina began to move northeast and approach Maury. This brought Maury under the influence of Nina's large low-level inflow. As a result, the weak ridge eroded and Maury began to accelerate to the north. As Maury accelerated to the north, the strong upper-level winds continued to displace Maury's convection away from the low-level center. This caused Maury's low-level circulation to become exposed (Figure 3-17-2) and marked the start of the weakening trend. The subtropical ridge located to the east of Maury was also a factor contributing to the acceleration. With these two factors combined, Maury reached a top speed of 26 kt (48 km/hr) between 300600Z and 301200Z.

The presence of the subtropical ridge dominated the JTWC forecast philosophy from the start. Maury was forecast to move around the ridge and recurve to the north-east. The actual movement was fairly close to the predicted track, although forecasting the speed of movement and the latitude of recurvature was difficult due to the influence of Nina.

Figure 3-17-2. The exposed low-level circulation of Maury is now located just northwest of the main convection. Nina which by now had weakened to 30 kt (15 m/s), is located almost due west (300042Z September DMSP visual imagery).

Figure 3-17-4. Imagery of Tropical Storm Nina just after the reconnaissance flight in Figure 3-17-3 was conducted. Maury is not locatable (010022Z October DMSP visual imagery).

At 301200Z, Maury was approximately 320 nm (593 km) northeast of Nina. Both storms were now moving to the northeast around the subtropical ridge. Instead of accelerating to the northeast like storms normally do, Maury slowed since it had entered Nina's larger circulation. With Nina moving to the northeast at 28 kt (52 km/hr) it took less than 12 hours to catch Maury and assimilate it into its circulation.

Maury was no longer identifiable on satellite imagery after 301831Z; however, aircraft reconnaissance several hours later was still able to locate both Maury and Nina (Figure 3-17-3). Satellite imagery at this time however, showed that only one storm, Nina, was present (Figure 3-17-4). At 010000Z, with Maury's continuation as a separate system highly unlikely, the final warning was issued.

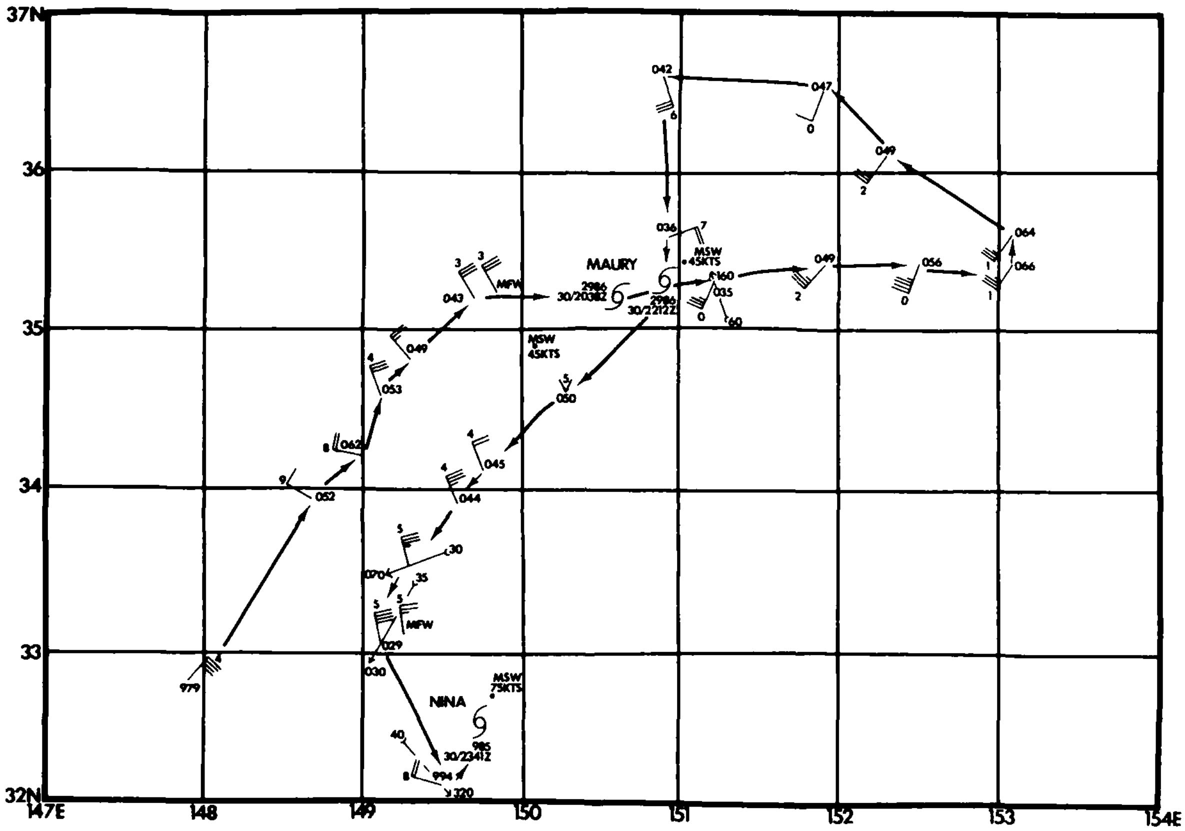
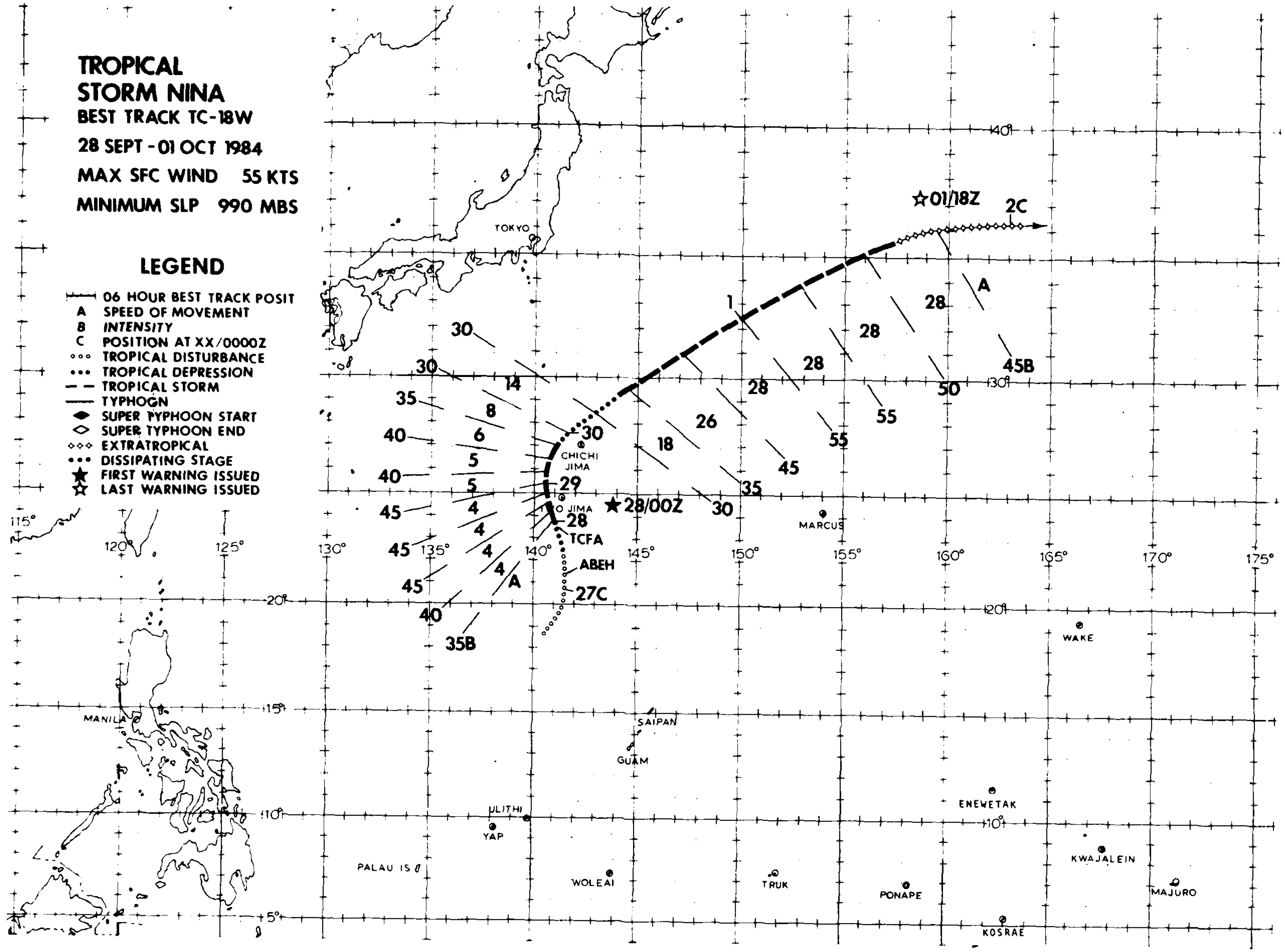


Figure 3-17-3. Although Tropical Storm Maury was no longer identifiable on satellite imagery, aircraft reconnaissance late on the 30th was still able to locate the storm's center. Wind and height data are from the 700 mb level. "MFW" represents the maximum observed flight level winds and "MSW" represents the maximum observed surface winds. The arrows with wind direction and speed represent the surface winds at that point. The number on the wind barb represents the tens digit of the 700 mb wind direction.


TROPICAL
STORM NINA
BEST TRACK TC-18W
28 SEPT - 01 OCT 1984
MAX SFC WIND 55 KTS
MINIMUM SLP 990 MBS
LEGEND
06 HOUR BEST TRACK POSIT
A SPEED OF MOVEMENT
B INTENSITY
C POSITION AT XX/0000Z
TROPICAL DISTURBANCE
TROPICAL DEPRESSION
TROPICAL STORM
TYPHOGN
SUPER TYPHOON START
SUPER TYPHOON END
EXTRATROPICAL
DISSIPATING STAGE
FIRST WARNING ISSUED
LAST WARNING ISSUED
TOKYO
CHICHI JIMA
O JIMA
MARCUS
WAKE
SAIPAN
GUAM
MANILA
ULITHI
YAP
PALAU IS
WOLEAI
TRUK
PONAPE
KOSRAE
ENEWETAK
KWAJALEIN
MAJURO
28/00Z
01/18Z
2C
TCFA
ABEH
27C
35B
45B

TROPICAL STORM NINA (18W)

Tropical Storm Nina was the third tropical storm to develop in the monsoon trough during the latter half of September. Despite originating in a region favorable for cyclogenesis, Nina never intensified beyond 55 kt (28 m/s). This was due to the inability of an upper-level anticyclone to persist over the storm. The last phase of Nina's life was noteworthy due to the storm's reintensification and assimilation of Tropical Storm Maury into its circulation.

On the 25th of September, a mid-latitude frontal system moved across the western North Pacific. As the front passed north of the monsoon trough, the trough was pulled to the northeast on the 26th. At 270000Z, the trough extended from the central Philippine Sea northeast to near Marcus Island (Minami Tori-Shima (WMO 47991)) where it became connected with the trailing edge of the cold front. Embedded in this trough were several weak circulations; most noticeable were the ones northeast and north-west of Guam. These would later develop into Tropical Storms Maury and Nina respectively.

Synoptic data at 270000Z indicated a closed 1004 mb circulation had formed 500 nm (926 km) north-northwest of Guam. The convection associated with the disturbance was poorly organized, but a large upper-level anticyclone north of Guam was providing good outflow channels to the south and east. During the following twelve hours the circulation and the associated convection moved north and consolidated. At 271200Z numerous ship reports indicated the system had intensified and was detaching from the trough. Tropical cyclone development during the next 24 hours now became a distinct possibility. Consequently, the Significant Tropical Weather Advisory (ABEH PGTW) was reissued at 271600Z upgrading the potential for development of this disturbance to "fair". This was followed by a TCFA at 272030Z based on satellite imagery which showed the disturbance was consolidating and becoming comma shaped.

The first aircraft reconnaissance flight into Nina took place late on the 27th and found only a sharp trough oriented northeast to southwest with an MSLP of 998 mb. However, a band of 30 to 40 kt (15 to 20 m/s) winds were observed south of the trough axis. This prompted the issuance of the first warning at 280000Z.

During the following 24 hours, Nina moved slowly north reaching an intensity of 45 kt (23 m/s) at 281200Z. Nina failed to develop a central dense overcast (CDO) as would be expected with normal tropical cyclone development. Instead, due to the displacement of the upper-level anticyclone to the east of the low-level circulation,

Figure 3-18-1. The broad exposed low-level circulation of Tropical Storm Nina (290102Z September NOAA visual imagery).

Nina more closely resembled a subtropical system. The convection was located poleward and eastward of the low-level center, and the radius of maximum winds was removed from the center. In addition, reconniassance aircraft found only sight temperature increases at the center.

This displacement of the convection north and east of the low-level center introduced uncertainty in the storm's position on the night of 28 September when the low-level circulation was poorly defined. Analysis of satellite imagery indicated that the upper-level circulation center passed east of Iwo-Jima (WMO 47981), but the surface winds at Iwo-Jima remained from the southeast until about 281800Z. This clearly indicates the surface circulation passed west of the island. During this time, synoptic data was essential in fixing the surface center since the low-level center was not locatable on satellite imagery.

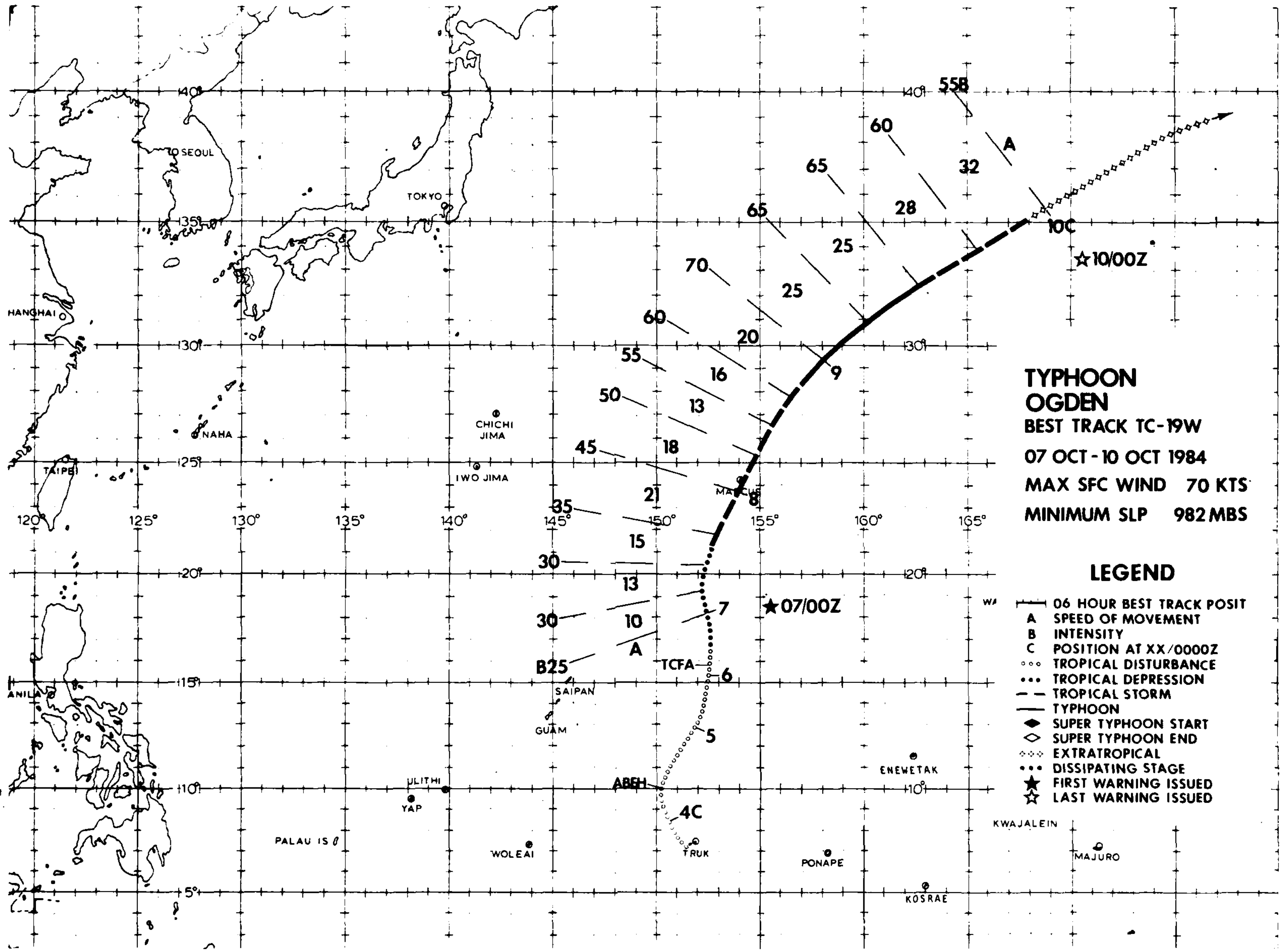
Early on the 29th, Nina entered the westerlies and the convection was displaced even further to the east remaining under the strongest upper-level diffluence. This resulted in a weakening of the storm. The broad low-level circulation was now continuously exposed, generally 100 to 180 nm (185 to 333 km) west of the main convection (Figure 3-18-1).

By early on the 30th, Nina had weakened to depression strength with reconnaissance aircraft unable to locate the low-level circulation center and satellite imagery indicating several possible low-level circulation centers. Nina was now forecast to dissipate over water during the next 12 to 24 hours. However, this weakening was to be temporary.

Figure 3-18-2. Tropical Storm Nina at maximum intensity. Maury is now assimilated into Nina's circulation (010022Z October DMSP visual imagery).

Between 300600Z and 301800Z, the low-level circulation moved rapidly northeast under the active convection resulting in a rapid reintensification of Nina. During this intensification, Tropical Storm Maury became incorporated into the larger circulation of Nina. However, there is no evidence to indicate that this intensification was due to the presence of Maury. At 0000Z on 1 October, Nina reached maximum intensity of 55 kt (28 m/s) (Figure 3-18-2).

Early on the first of October, extratropical transition began. The convection rapidly decreased during the day as Nina continued to the northeast. Nina became extratropical between 011200Z and 011500Z, with the final warning being issued at 011800Z.


TYPHOON
OGDEN
BEST TRACK TC-19W
07 OCT - 10 OCT 1984
MAX SFC WIND 70 KTS
MINIMUM SLP 982 MBS
LEGEND
06 HOUR BEST TRACK POSIT
A SPEED OF MOVEMENT
B INTENSITY
C POSITION AT XX/0000Z
TROPICAL DISTURBANCE
TROPICAL DEPRESSION
TROPICAL STORM
TYPHOON
SUPER TYPHOON START
SUPER TYPHOON END
EXTRATROPICAL
DISSIPATING STAGE
FIRST WARNING ISSUED
LAST WARNING ISSUED
10/00Z
07/00Z
10C
TCFA
ABEH
4C
SEOUL
TOKYO
HANGHAI
TAIPEI
NAHA
CHICHI JIMA
IWO JIMA
MARCUS
SAIPAN
GUAM
ANILA
ULITHI
YAP
PALAU IS
WOLEAI
TRUK
PONAPE
ENEWETAK
KOSRAE
KWAJALEIN
MAJURO

TYPHOON OGDEN (19W)

Typhoon Ogden was the first of a series of eight tropical cyclones during the month of October which established a new record for northwest Pacific tropical cyclone activity for that month. Ogden like the two storms before it, moved almost due north from the time it developed until it began to recurve. Ogden had great difficulty in becoming vertically aligned and would probably never have attained typhoon intensity if it had not accelerated after recurvature thereby adding the translation speed of movement to the storm's wind field.

The disturbance that developed into the eighth typhoon of the season was initially detected as a weak surface circulation west of Truk (WMO 91334) on the 3rd of October. No significant convection directly associated with the circulation was evident on satellite imagery at the time. The disturbance moved to the northwest over the next 18 hours and became part of the eastward extension of the resurging southwest monsoon trough. Synoptic data at 040000Z indicated a 10 to 20 kt (5 to 10 m/s) surface circulation was present, with an MSLP near 1008 mb. The persistence of the circulation prompted its inclusion in the 040600Z Significant Tropical Weather Advisory (ABEH PGTW).

The monsoon trough began to extend northwestward on the 4th as it had a week earlier when Tropical Storms Maury and Nina developed. As the circulation became embedded in the trough, the disturbance followed the trough orientation and tracked to the northeast. Some poorly organized convection associated with the surface circulation could now be detected on satellite imagery. Upper-level flow up to this time was weak but generally diffluent.

On 5 October, the convection indicated a further improvement in organization and was now consolidating in the northeast periphery of the monsoon trough, several degrees northeast of the surface circulation. An upper-level anticyclone was also observed to be developing over the disturbance. Early on the 6th, the convection moved slightly southwest and continued to increase in size and organization. This brought the low-level circulation in closer proximity to the mid and upper-level features.

It was determined from sparse synoptic data at 060000Z that the circulation had turned more northward with an MSLP likely below 1004 mb. This led to the issuance of a TCFA at 060400Z. At 060600Z, a ship near the disturbance's center reported a 1002 mb pressure to confirm the earlier analysis.

The first of seven aircraft reconnaissance flights into Ogden occurred early on 6 October. A surface center was not located but a sharp low-level trough oriented northeast to southwest with an MSLP of 1000 mb was evident. Maximum sustained winds of 20 kt (10 m/s) were reported southeast of the trough axis. The second aircraft reconnaissance mission closed-off a circulation center at 062227Z with an MSLP of 999 mb and reported 15 kt (8 m/s) winds near the broad center. Winds of 35 kt (18 m/s) were found approximately 170 nm (315 km) east-northeast of the center associated with the tight pressure gradient between the developing Ogden and the subtropical ridge to the northeast. Intensity estimates from satellite analysis at this time indicated surface winds of 25 kt (13 m/s) were present. Although the disturbance was still located within the monsoon trough, satellite data indicated the system was moving north and separating from the trough. This in combination with the aircraft data prompted the issuance of the first warning on Ogden as a 25 kt (13 m/s) tropical depression at 070000Z (Figure 3-19-1).

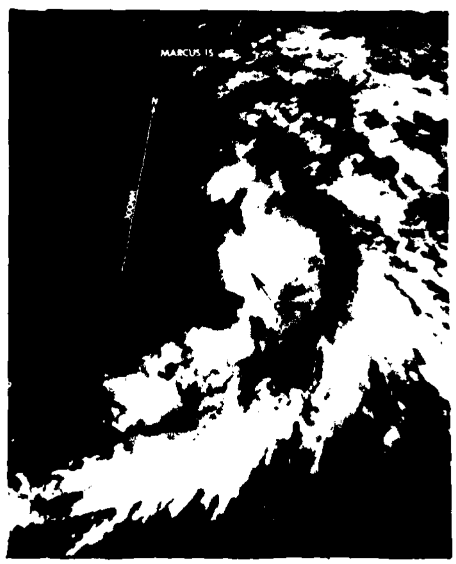


Figure 3-19-1. Ogden at the time the first warning was issued. Dvorak intensity analysis indicated that 25 kt (13 m/s) surface winds were present (070002Z October DMSP visual imagery).

Over the next 24 hours, Ogden tracked around the southwest periphery of the mid-Pacific ridge. The ridge was retreating eastward in advance of a mid-latitude trough approaching from Japan. Although the first four JTWC warnings forecast eventual recurvature to the *northeast*, the actual recurvature was much sharper than anticipated, with significant acceleration occurring during the first twenty-four hours of the forecast period. This was due to the mid-latitude trough moving east faster than anticipated, resulting in a more rapid retreat of the mid-Pacific ridge. This quickly put Ogden under a southwesterly steering flow.

At approximately 071600Z, Ogden obtained tropical storm intensity. At this time, Ogden was already accelerating to the northeast. Part of the storm's intensification during the next 30 hours would be a result of the forward translational speed being added to the true wind speed. This would consistently put the stronger winds in the southeast semicircle.

The only land affected by Ogden was Marcus Island (Minami Tori-Shima (WMO 47991)). Ogden passed just to the east of the island at approximately 080200Z. The island was subjected to the weaker, northwest semicircle of the storm, and as a result, no damage was reported. The highest known wind occurred at 080000Z when northeast winds of 27 kt (14 m/s) were observed. At the same time the sea-level pressure was 990.3 mb. Only two hours earlier, aircraft reconnaissance reported an MSLP in Ogden of 993 mb. This suggests that the intensifying surface center passed very close to the island.

At 1200Z on 8 October, the mid-latitude westerlies began to accelerate Ogden to the northeast in earnest and Ogden began its transition to an extratropical low as it attained typhoon intensity (Figure 3-19-2). A combination of the extratropical transition and a 20 kt (37 km/hr) northeast movement contributed to an expanded asymmetric wind field and to the typhoon force winds in the southeast semicircle. Aircraft reconnaissance at 082132Z reported 70 kt (36 m/s) surface winds 30 nm (56 km) from the surface center in the southwest and southeast quadrants.

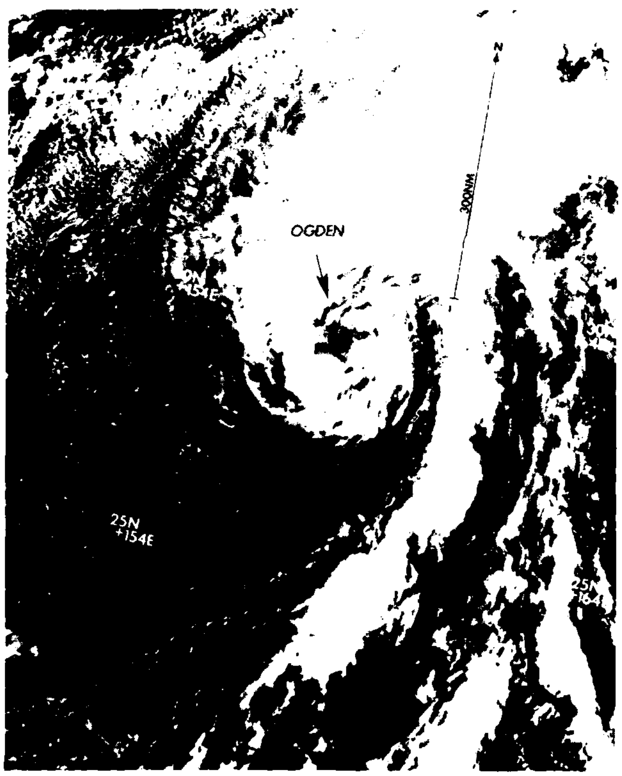
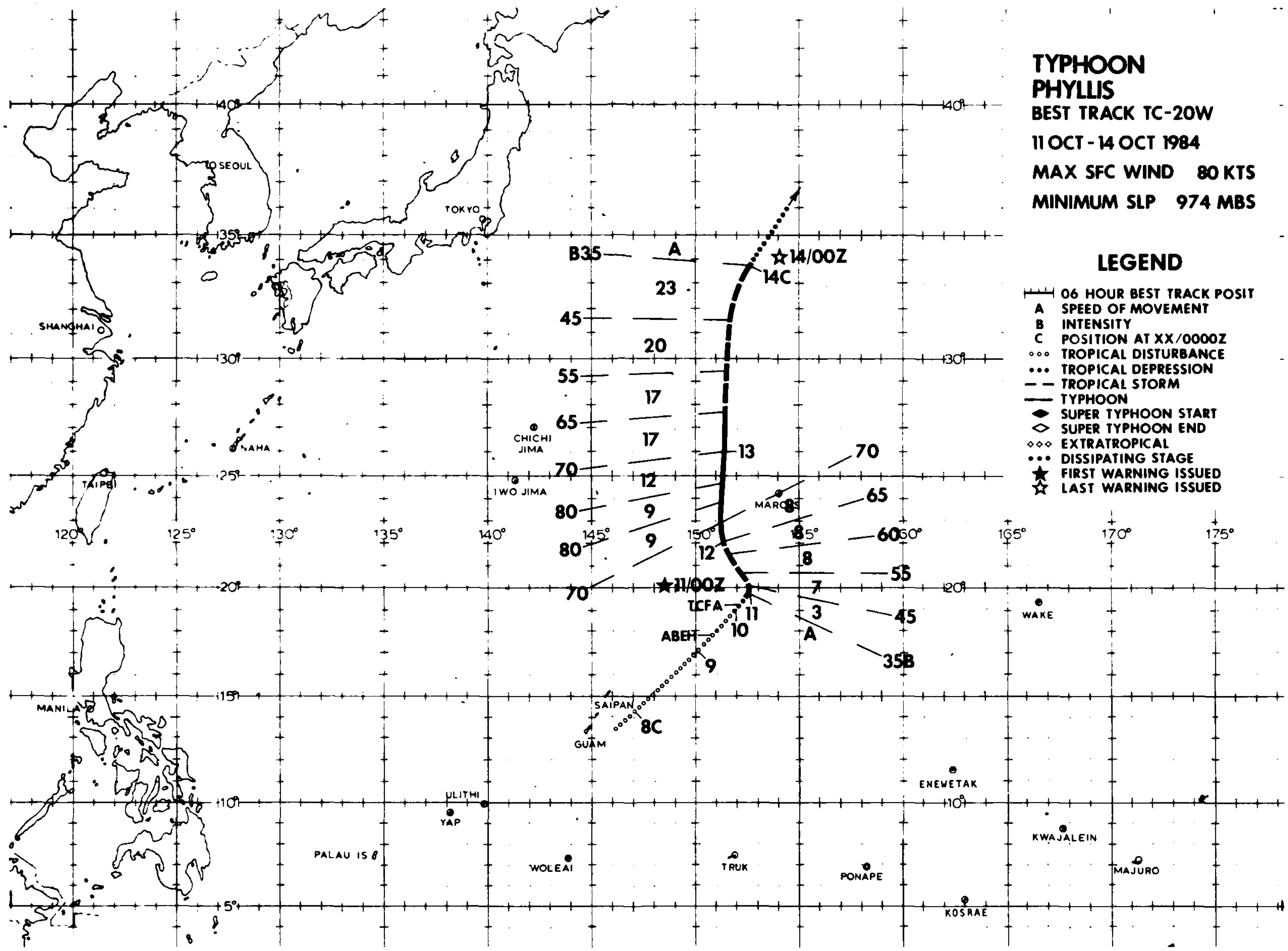


Figure 3-19-2. Typhoon Ogden near maximum intensity. Ogden was already beginning its extratropical transition at this time (082321Z October DMSP visual imagery).

The ARWO also verified that extratropical transition had commenced. Stratiform clouds were observed in the surface center and a 10 nm (19 km) northeast tilt was present from the surface to the 700 mb center. In addition, the measured MSLP was only 993 mb. This would normally support winds of 55 kt (28 m/s) according to Atkinson-Holliday (1977) pressure-wind curve. This discontinuity is often observed during extratropical transition.

The southwesterlies continued to shear Ogden as it accelerated to the northeast, further separating the 700 mb and upper-level centers from the surface center. Ogden weakened to tropical storm strength approximately twenty-four hours after it obtained typhoon strength, even though maximum sustained winds of 77 kt (40 m/s) were indicated from satellite imagery. The satellite intensity estimates at this time were based on the Dvorak model of a subtropical system. Consequently, Ogden's 25 kt (46 km/hr) movement was directly added to the initial model intensity. It was apparent on satellite imagery at 0000Z on 10 October that Ogden had lost all convection and had completed its extratropical transition. It still supported 55 kt (28 m/s) winds and had a 32 kt (59 km/hr) northeast movement. At this time, the final warning was issued. The upper-level center was located more than one degree northeast of the surface center based on satellite imagery. The remains of Ogden continued northeast towards the International Dateline as an extratropical storm.


TYPHOON
PHYLLIS
BEST TRACK TC-20W
11 OCT - 14 OCT 1984
MAX SFC WIND 80 KTS
MINIMUM SLP 974 MBS
LEGEND
06 HOUR BEST TRACK POSIT
A SPEED OF MOVEMENT
B INTENSITY
C POSITION AT XX/0000Z
TROPICAL DISTURBANCE
TROPICAL DEPRESSION
TROPICAL STORM
TYPHOON
SUPER TYPHOON START
SUPER TYPHOON END
EXTRATROPICAL
DISSIPATING STAGE
FIRST WARNING ISSUED
LAST WARNING ISSUED
14/00Z
14C
11/00Z
TCFA
ABEH
8C
SEOUL
TOKYO
SHANGHAI
NAHA
TAIPEI
CHICHI JIMA
IWO JIMA
MARCUS
WAKE
SAIPAN
GUAM
MANILA
ULITHI
YAP
PALAU IS
WOLEAI
TRUK
PONAPE
KOSRAE
ENEWETAK
KWAJALEIN
MAJURO

TYPHOON PHYLLIS (20W)

Typhoon Phyllis was the first of four significant tropical cyclones to develop in the monsoon trough during a two day period. Three of these would form in WESTPAC, with the fourth, Tropical Cyclone 02B developing in the Bay of Bengal. Of the four, Phyllis was by far the strongest, reaching a maximum intensity of 80 kt (41 m/s). However, despite its strength, Phyllis caused no reported damage as it remained over water throughout its life.

As an intenisfying Typhoon Ogden began to accelerate to the northeast on 7 October, a broad area of troughing and low-level convergence persisted in its wake. By late on the 7th, the seedling of Phyllis was being analyzed as a weak surface circulation embedded in the trough east of Guam. During the next day-and-a-half, the disturbance drifted to the northeast with no significant development noted. Figure 3-20-1 depicts the surface situation at 090000Z as Phyllis finally began to develop. A broad trough extends southwest from Typhoon Ogden across Guam and into the Philippine Sea. Embedded in this trough are two circulations; one to the northeast and one to the southwest of Guam. These would later develop into Typhoon Phyllis and Tropical Storm Roy respectively.

Although surface synoptic data was sparse near the circulation northeast of Guam, satellite imagery during the 9th and into the 10th indicated that a compact circulation was developing. This resulted in a TCFA being issued at 100630Z. At the time the TCFA was issued, Dvorak intensity analysis indicated that surface winds of 25 kts (13m/s) were present.

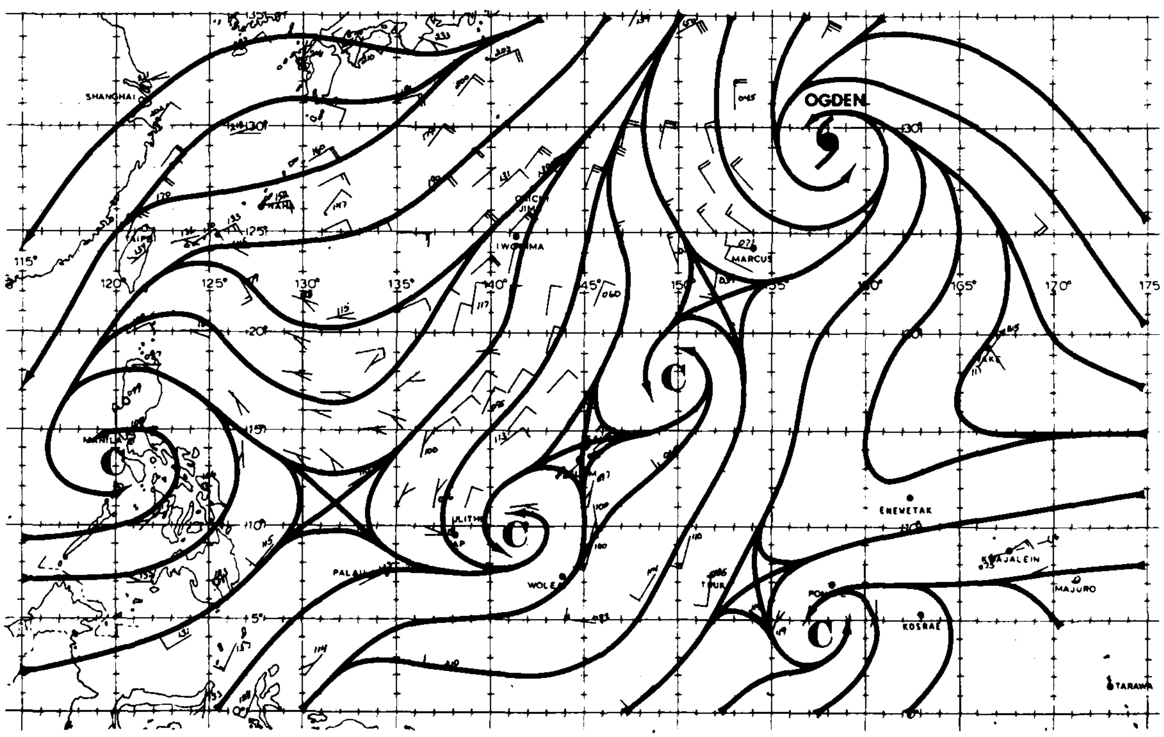


Figure 3-20-1. Surface analysis at the time Typhoon Phyllis and Tropical Storm Roy began to develop (090000Z October 1984).

The first warning on Phyllis was issued at 110000Z after satellite imagery indicated the disturbance had intensified further and now supported winds of 35 kt (18 m/s). By now Phyllis had nearly detached from the trough and would soon begin to accelerate to the north. During the next twenty-four hours Phyllis intensified rapidly reaching typhoon strength by 120000Z. The upgrade to typhoon status was based upon reports from reconnaissance aircraft and from Dvorak intensity analysis of Figure 3-20-2.

Phyllis continued to strengthen reaching a maximum intensity of 80 kt (41 m/s) twelve hours later at 121200Z. At the time Phyllis attained its peak intensity, it was located under a well-defined synoptic scale anticyclone (Figure 3-20-3). This anticyclone provided good outflow to all quadrants of the storm. As Phyllis moved north, however, the anticyclone would remain quasi-stationary near Marcus Island (Minami Tori-Shima (WMO 47991)). As a result, less than twelve hours later Phyllis would enter the 50 to 70 kt (26 to 39 m/s) westerly flow and begin to shear and weaken.

Typhoon Phyllis maintained a predominantly northward track from the time it separated from the monsoon trough until it began to dissipate. The initial movement northward was a result of Typhoon Ogden weakening and displacing the subtropical ridge to the east. As Phyllis began to move north, a digging mid-latitude shortwave formed a vigorous cut-off low south of Honshu. This allowed the ridge east of Phyllis to rapidly build back northward, keeping Phyllis under a strong southerly steering flow. This southerly flow resulted in Phyllis accelerating to the north and prevented the typhoon from following a more typical recurvature track to the northeast.

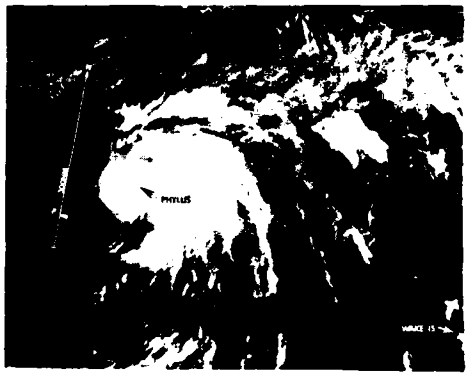


Figure 3-20-2. Phyllis at the time it was upgraded to typhoon intensity. Dvorak intensity analysis of this imagery indicated that surface winds of 65 kt (33 m/s) were present (120002Z October DMSP visual imagery).

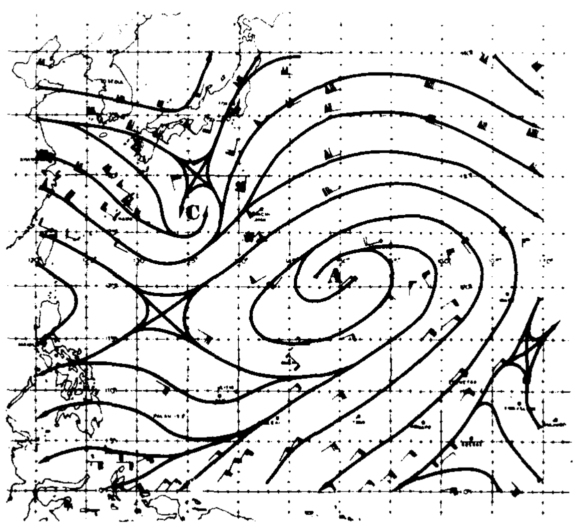
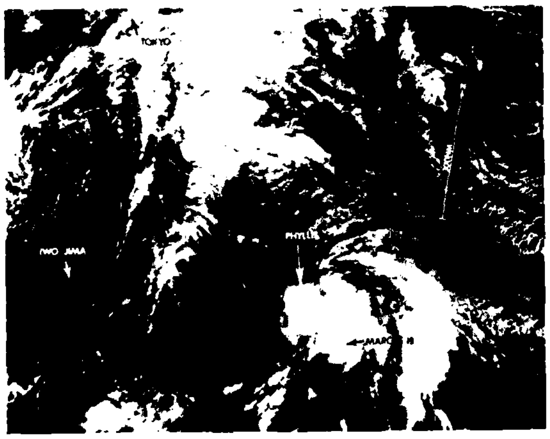


Figure 3-20-3. 200 mb analysis at the time Typhoon Phyllis attained maximum intensity. The synoptic scale anticyclone is located directly over Phyllis. The mid-level cut-off low south of Honshu extended through the 200 mb level (121200Z October 1984).

As Phyllis passed north of 25N, the cut-off low with its associated frontal system began to accelerate to the northeast. At the same time, Phyllis began to encounter the strong upper-level westerlies and the convection was displaced to the east of the low-level circulation (Figure 3-20-4). Phyllis responded by weakening at an even faster rate than it had earlier intensified.

The last aircraft reconnaissance mission was flown into Phyllis late on 13 October and found only a trough at the 700 mb level where less than twelve hours earlier, a well-developed circulation existed. At the surface, however, the aircraft still found a 999 mb surface circulation. Satellite imagery at nearly the same time showed a broad low-level circulation center defining the remnants of Phyllis (Figure 3-20-5). All the convection had been displaced to the northeast. At 140000Z, the final warning was issued as Phyllis became indistinct from the cold front transiting through the region. There were no reports of damage from Phyllis although Marcus Island (Minami Tori-Shima (WMO 47991)) did report 20 to 30 kt (10 to 15 m/s) winds for almost two days as Phyllis passed some 150 nm (278 km) to the west.

Figure 3-20-4. Typhoon Phyllis as it began to weaken under strong upper-level wind shear. Note the extratropical low with its associated frontal system to the west (122342Z October DMSP visual imagery).



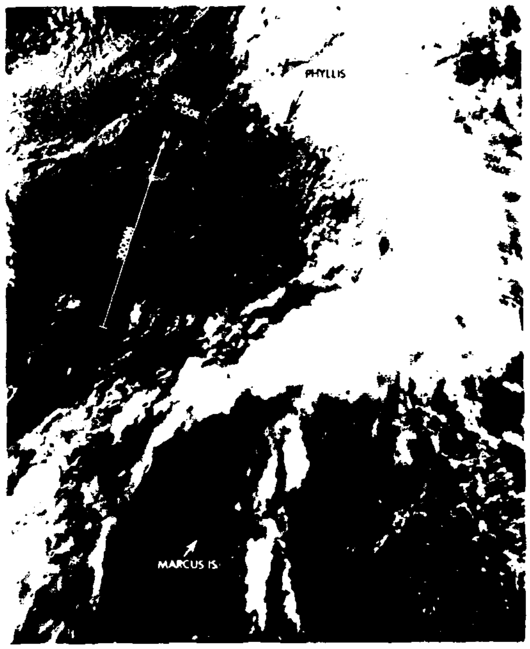
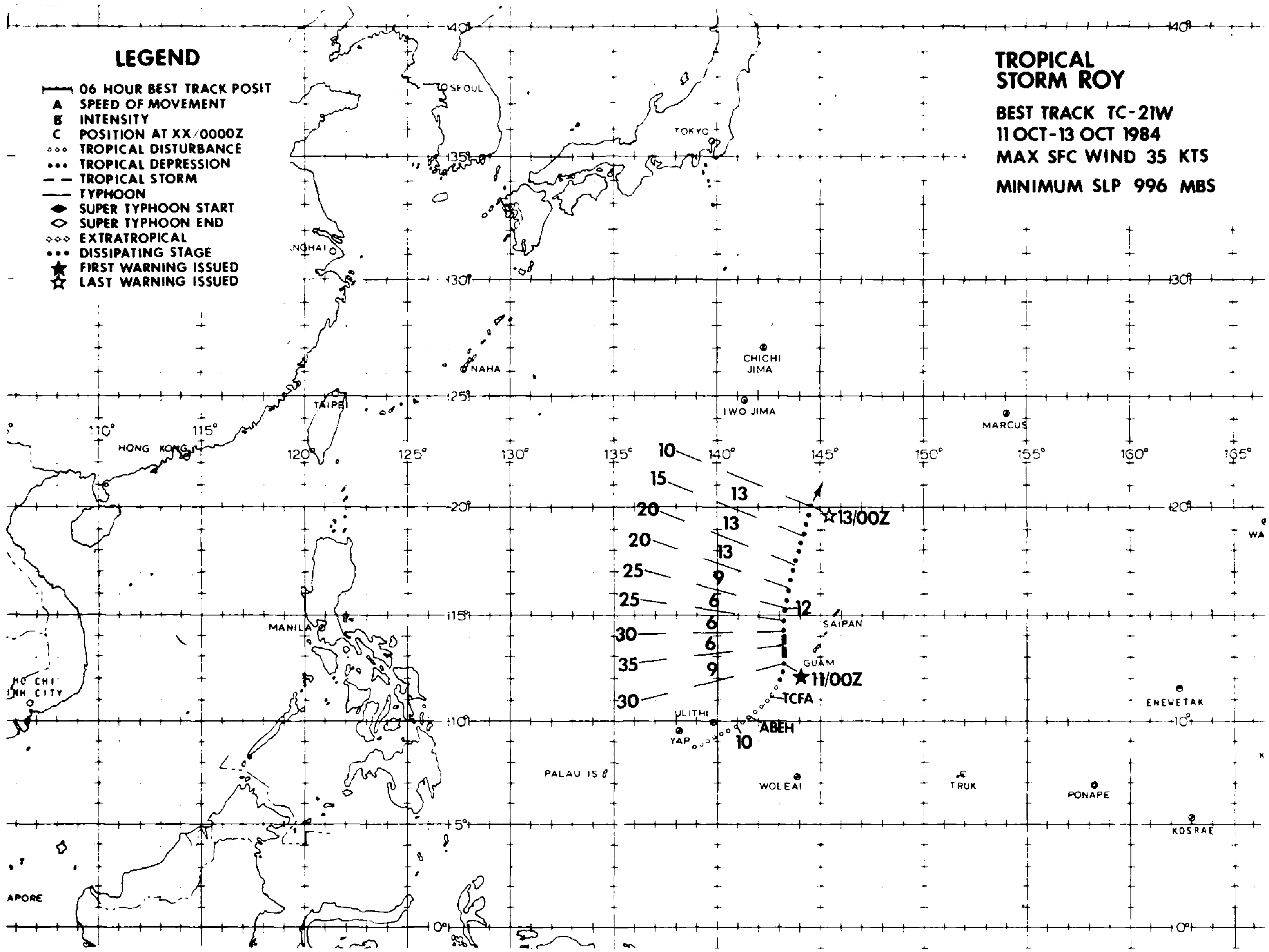


Figure 3-20-5. Phyllis as it merged with and became indistinct from a cold front. All that remained of Phyllis was a broad low-level circulation center (132321Z October DMSP visual imagery)


LEGEND
06 HOUR BEST TRACK POSIT
A SPEED OF MOVEMENT
B INTENSITY
C POSITION AT XX/0000Z
TROPICAL DISTURBANCE
TROPICAL DEPRESSION
TROPICAL STORM
TYPHOON
SUPER TYPHOON START
SUPER TYPHOON END
EXTRATROPICAL
DISSIPATING STAGE
FIRST WARNING ISSUED
LAST WARNING ISSUED
TROPICAL STORM ROY
BEST TRACK TC-21W
11 OCT-13 OCT 1984
MAX SFC WIND 35 KTS
MINIMUM SLP 996 MBS
13/00Z
11/00Z
TCFA
ABEH
SEOUL
TOKYO
NAHA
TAIPEI
HONG KONG
MANILA
CHICHI JIMA
IWO JIMA
MARCUS
SAIPAN
GUAM
ULITHI
YAP
PALAU IS
WOLEAI
TRUK
PONAPE
ENEWETAK
KOSRAE

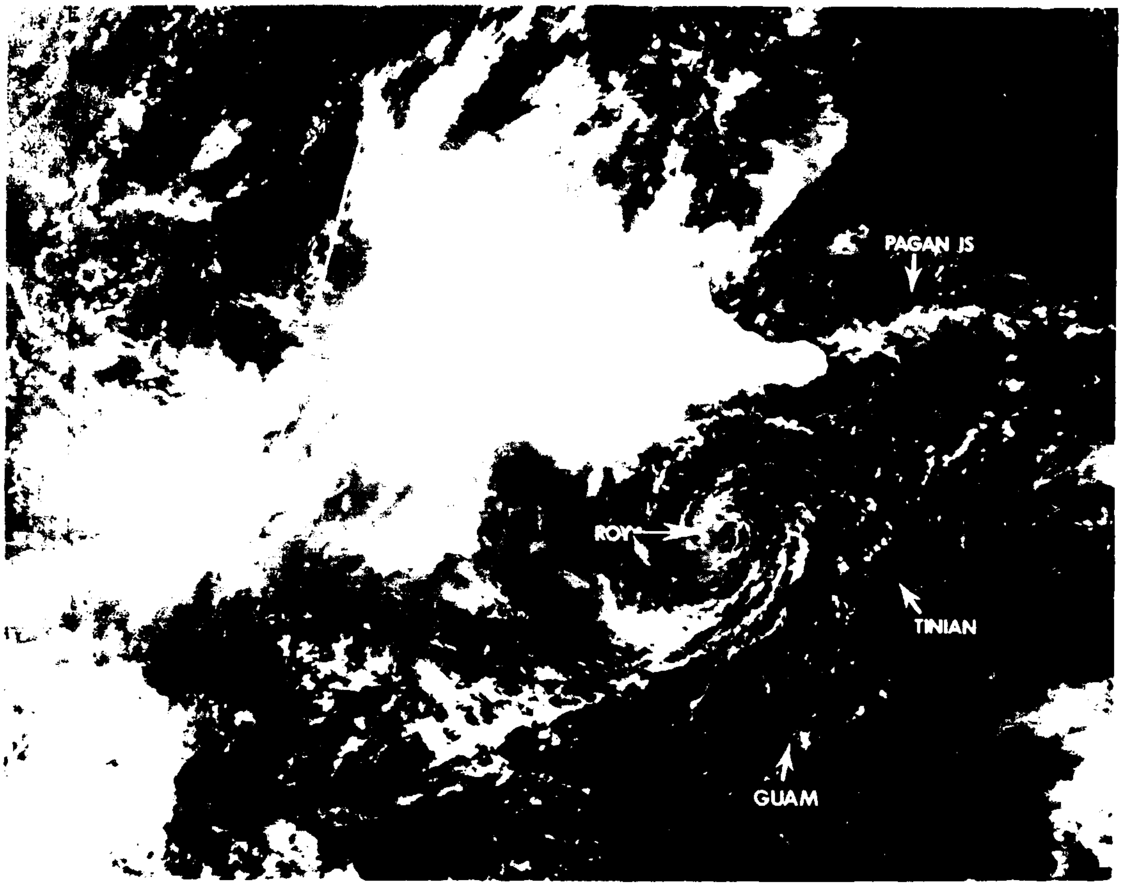
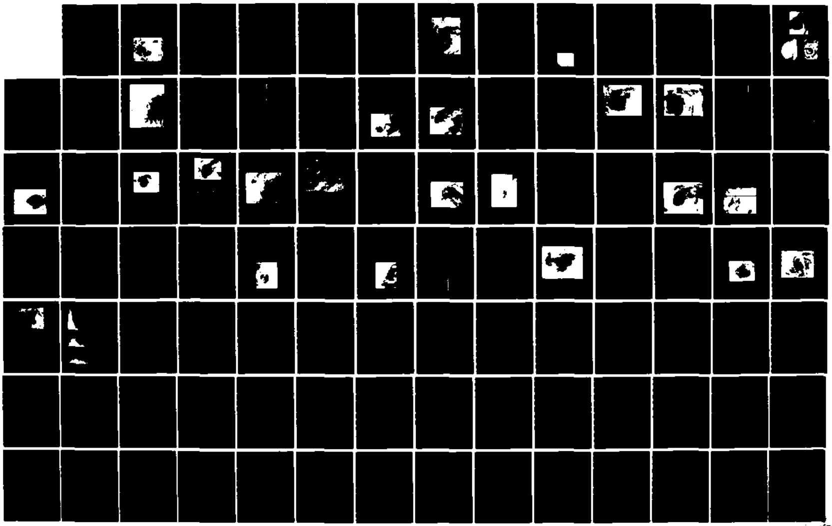
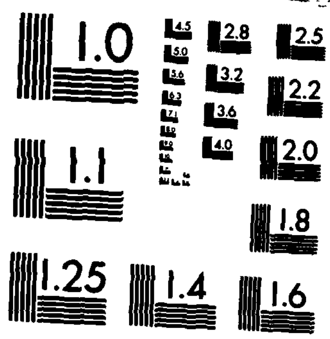


Figure 3-21-2. Tropical Storm Roy as an exposed low-level circulation center is located southeast of the convection (120002Z DMSP visual imagery).

AD-A153 395 1984 ANNUAL TROPICAL CYCLONE REPORT(U) NAVAL OCEANOGRAPHY COMMAND CENTER/JOINT TYPHOON WARNING CENTER FPO SAN FRANCISCO 96630 K G HINMAN ET AL. 1984 2/3

UNCLASSIFIED F/G 4/2 NL




1.0
2.8
2.5
3.2
2.2
3.6
4.0
2.0
1.1
1.8
1.25
1.4
1.6

TROPICAL STORM ROY (21W)

Tropical Storm Roy developed in the monsoon trough southwest of Guam at the same time that Typhoon Phyllis was developing further to the northeast. Despite forming in an area climatologically favorable for tropical cyclone development, Roy was unable to persist. Strong upper-level wind shear resulted in a rapid weakening and eventual dissipation of the storm after only two days in warning status.

Early on 9 October, a weak circulation was first analyzed in the monsoon trough southwest of Guam. Development of the disturbance was slow during the next twenty-four hours due to strong wind shear from the upper-level outflow of Typhoon Ogden. By early on the 10th, Ogden's influence had lessened which resulted in the convection over the disturbance increasing and becoming more organized. At 100400Z, Dvorak intensity analysis of the convective banding indicated that 25 kt (13 m/s) surface winds were present. This prompted the issuance of a TCFA at 100700Z.

During the development stage no upper-level anticyclone was detected over the disturbance, although the flow did become diffluent. As it turned out, Roy never developed an upper-level anticyclone. This inability to develop a good outflow pattern would ultimately be responsible for Roy's quick dissipation.

The first aircraft reconnaissance mission into the system found a small 1000 mb center at 110046Z located approximately 90 nm (167 km) west-southwest of Guam. Winds of 15 kt (8 m/s) were found around most of the center except for a small area of 30 kt (15 m/s) winds in the southeast quadrant. The aircraft position of the disturbance's center confirmed what satellite imagery indicated - that the system had turned to a more northerly heading from the steady northeast course of the previous two days. This meant Roy would pass safely to the west of Guam.

Based on the data obtained by reconnaissance aircraft and the expectation for further intensification, the first warning was issued at 110227Z, valid at 110000Z (Figure 3-21-1). Later that afternoon the second reconnaissance flight found Roy had indeed intensified. The MSLP had decreased to 998 mb and minimal tropical storm force winds existed 20 to 30 nm (37 to 56 km) from the center.

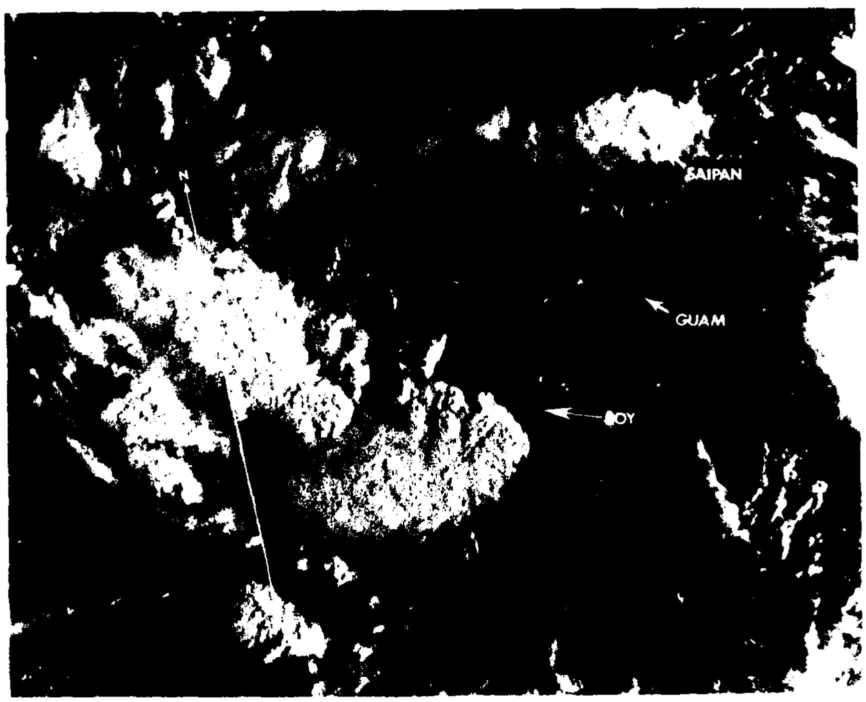


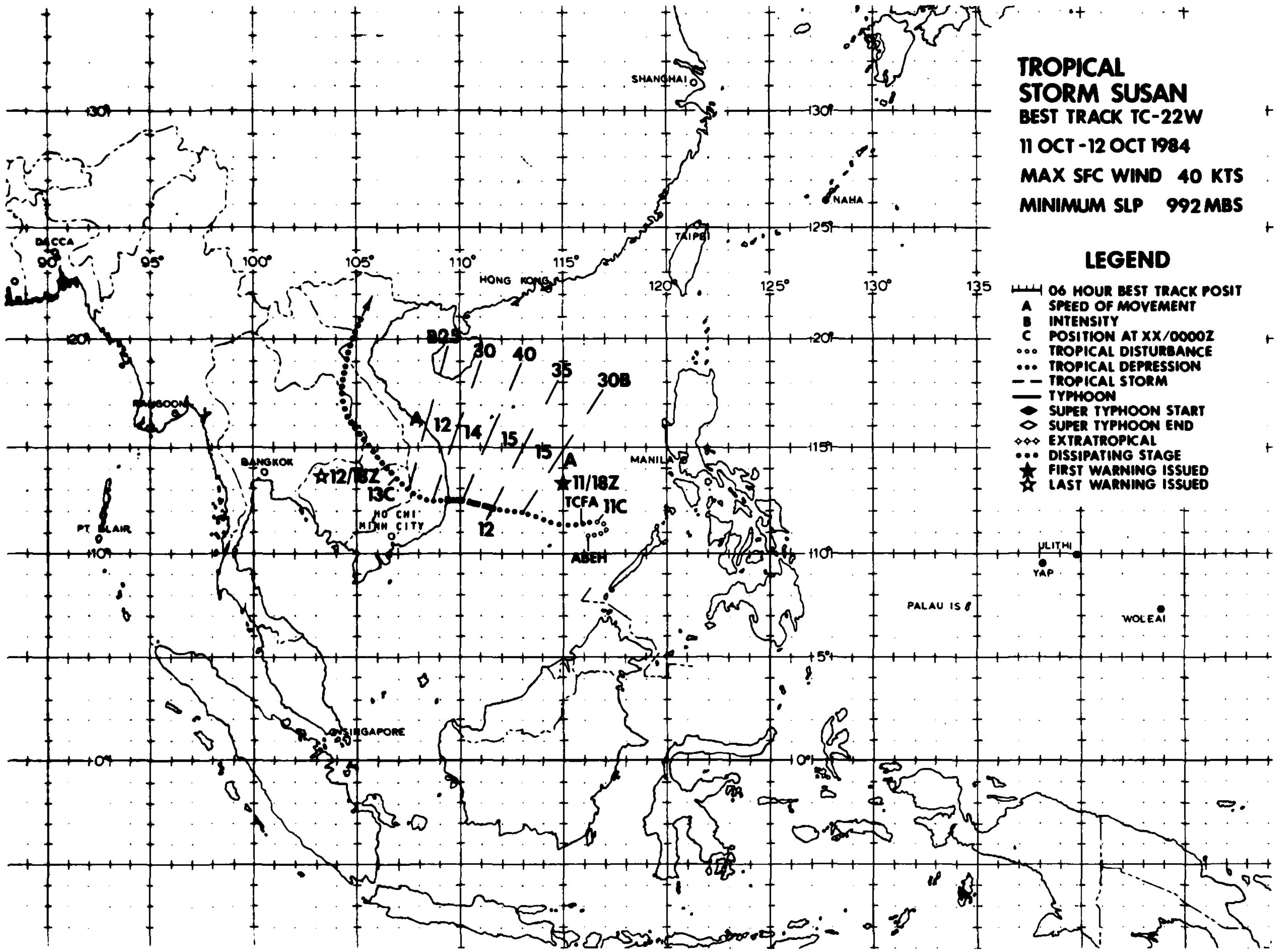
Figure 3-21-1. Roy just before the first warning was issued. The partially exposed low-level circulation center is visible on the eastern edge of the main convection. The island of Guam located 110 nm (204 km) to the northeast is completely cloud-free (102152Z October NOAA visual imagery).

As it turned out, these would be the strongest winds observed in Roy. Roy passed 80 nm (148 km) west of Guam as a minimal tropical storm, but caused no damage to the island. The Naval Oceanography Command Detachment (NOCD) at Brewer Field, NAS Agana, recorded maximum winds of only 14 kt (7 m/s) during Roy's passage.

As Roy moved to the north-northeast, strong easterlies from the synoptic scale anticyclone that was nearly co-located with the developing Typhoon Phyllis began to shear the storm. In addition, much of the monsoon flow which had earlier been directed into Roy was now feeding into the stronger Typhoon Phyllis. This began a weakening trend which continued until Roy's dissipation less than 36 hours later.

During the next twenty-four hours, Roy did make several attempts to redevelop its convection about the low-level circulation center, but due to the strong shear, every attempt was doomed to fail. By the 12th, Roy had become an exposed system with the overall convection decreasing (Figure 3-21-2). However, it was at this time that the lowest MSLP was observed. At 120531Z, reconnaissance aircraft recorded an MSLP of 996 mb. Despite the lower pressures, no surface winds above 20 kt (10 m/s) were reported.

Late on the 12th, the last mission into the dissipating Roy was flown. It was unable to locate any circulation center and observed surface winds of 5 to 15 kt (3 to 8 m/s). This prompted the final warning to be issued at 130000Z as Roy dissipated over water.


TROPICAL
STORM SUSAN
BEST TRACK TC-22W
11 OCT - 12 OCT 1984
MAX SFC WIND 40 KTS
MINIMUM SLP 992 MBS
LEGEND
06 HOUR BEST TRACK POSIT
A SPEED OF MOVEMENT
B INTENSITY
C POSITION AT XX/0000Z
TROPICAL DISTURBANCE
TROPICAL DEPRESSION
TROPICAL STORM
TYPHOON
SUPER TYPHOON START
SUPER TYPHOON END
EXTRATROPICAL
DISSIPATING STAGE
FIRST WARNING ISSUED
LAST WARNING ISSUED
SHANGHAI
NAHA
TAIPEI
HONG KONG
MANILA
BANGKOK
HO CHI MINH CITY
RANGOON
DACCA
PT BLAIR
SINGAPORE
ABEH
PALAU IS
YAP
ULITHI
WOLEAI
11/18Z
TCFA 11C
12/18Z
13C
B025
30
40
35
30B
A
12
14
15
15
A
12

TROPICAL STORM SUSAN (22W)

Tropical Storm Susan was the third of four significant tropical cyclones to develop in the monsoon trough in less than two days. During a brief existence Susan caused considerable damage to central Vietnam despite only intensifying to 40 kt (21 m/s).

Occasionally, when a typhoon is active in the Philippine Sea a "sympathetic" storm will form in the South China Sea. Recent examples of such storm pairs are Abby/Carmen and Orchid/Percy from the 1983 season. The mechanism at work in these cases is a combination of excess vorticity and convergence at low-levels, found around circulation centers embedded in the monsoon trough, and upper-level ventilation due to the divergence in the outflow downstream (west) of the dominant typhoon in the Philippine Sea. These "sympathetic" storms often exhibit erratic movement and are the victims of significant upper-level shearing. Intensification beyond minimal typhoon strength is unusual.

As a first impression, one might assume that this scenario was valid in the case of Tropical Storm Susan. The surface situation present as Susan was forming is shown in Figure 3-22-1. The monsoon trough extends from the Marshall Islands across Micronesia, the Philippines, Southeast Asia and into the Bay of Bengal. Embedded within this trough is the precursor of Tropical Cyclone 02B in the Bay of Bengal, the depression that is soon to be Susan in the South China Sea and the short-lived Tropical Storm Roy just west of Guam. Tropical Storm Phyllis (soon to be typhoon Phyllis) had recently separated from the trough and was accelerating to the north. The first impression, however, is incorrect in this case. Susan was not a sympathetic storm induced by either of the storms to the east, but was instead a completely independent system. The inflow patterns about Roy and Phyllis disrupt each other whereas the flow around Susan dominates the entire South China Sea and controls much more mass than the other two. Given time and more open ocean, Susan would probably have become the most intense of the four systems.

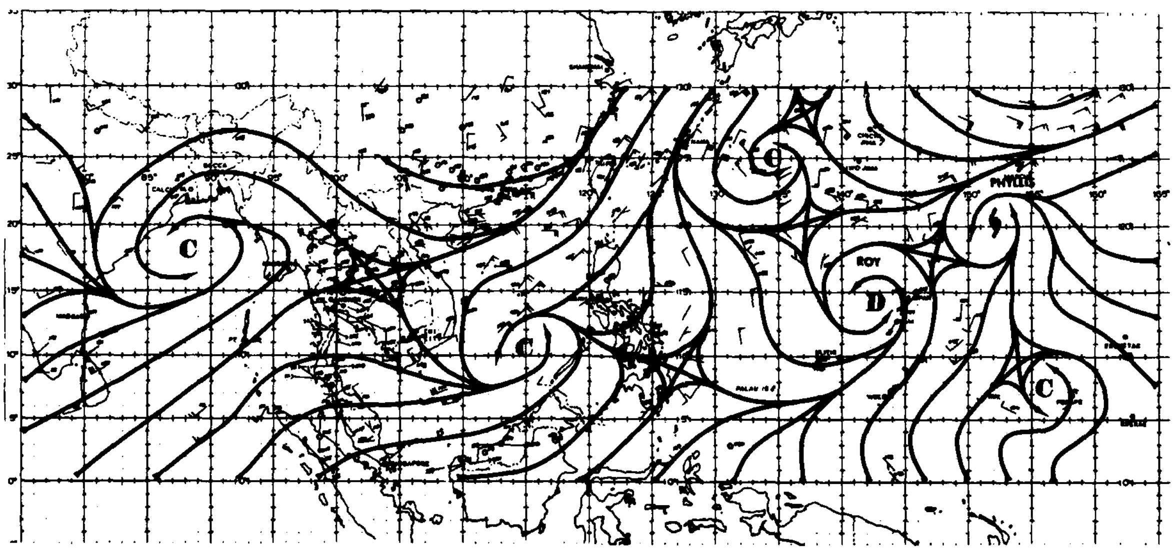


Figure 3-22-1. The 111200Z October surface/gradient level analysis during the formative stage of Tropical Storm Susan.

The upper-air pattern present during the development stage of Susan is shown in Figure 3-22-2. The anticyclone over the South China Sea is well-formed and distinct from one northeast of Guam. In fact, the upper-level anticyclone over the Pacific Ocean does not resemble the typical outflow pattern from a tropical storm. The system is much more representative of the climatological synoptic scale high. The overall pattern shows clearly that Susan developed on its own merits and not as a result of a "sympathetic" reaction.

The disturbance, which would later develop into Susan, was first noticed on 10 October as a loosely defined but very broad low-level circulation in the central South China Sea. Synoptic data showed that winds of 10 to 20 kt (5 to 10 m/s) were present with the disturbance. The inflow pattern covered a very large area and was slow to consolidate. During this consolidation period the system remained nearly stationary.

By 110600Z the system had started to accelerate to the west along the axis of the monsoon trough. The convection and organization had both increased significantly, resulting in the issuance of a TCFA at 110730Z. By now winds near the center were 20 to 25 kt (10 to 13 m/s). The storm continued to develop as it moved quickly to the west-northwest, with the first warning issued at 111800Z. Susan made landfall as a 35 to 40 kt (18 to 21 m/s) tropical storm just north of Nha Trang, Vietnam (WMO 48877) some 16 hours later (Figure 3-22-3). After landfall, Susan turned northwest and

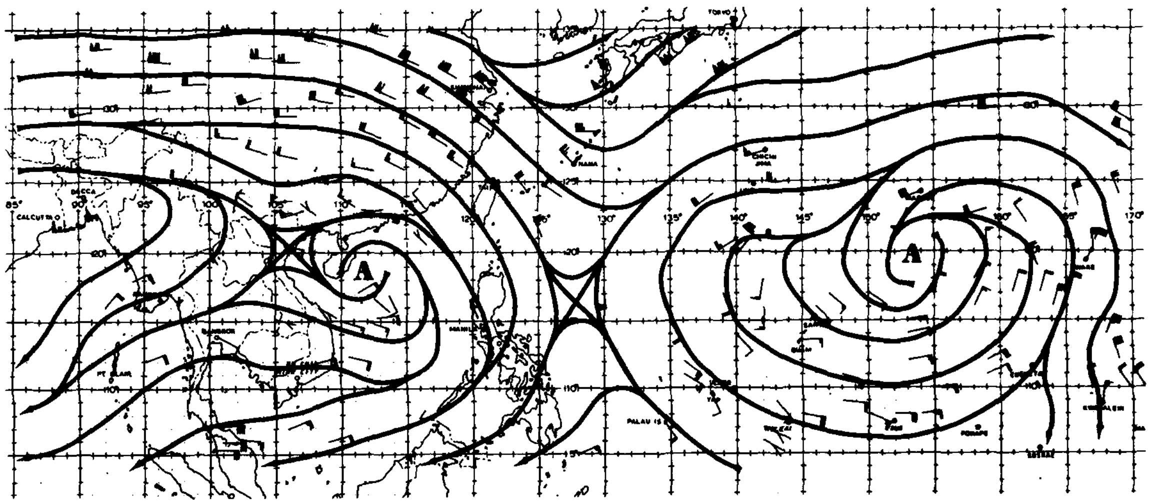
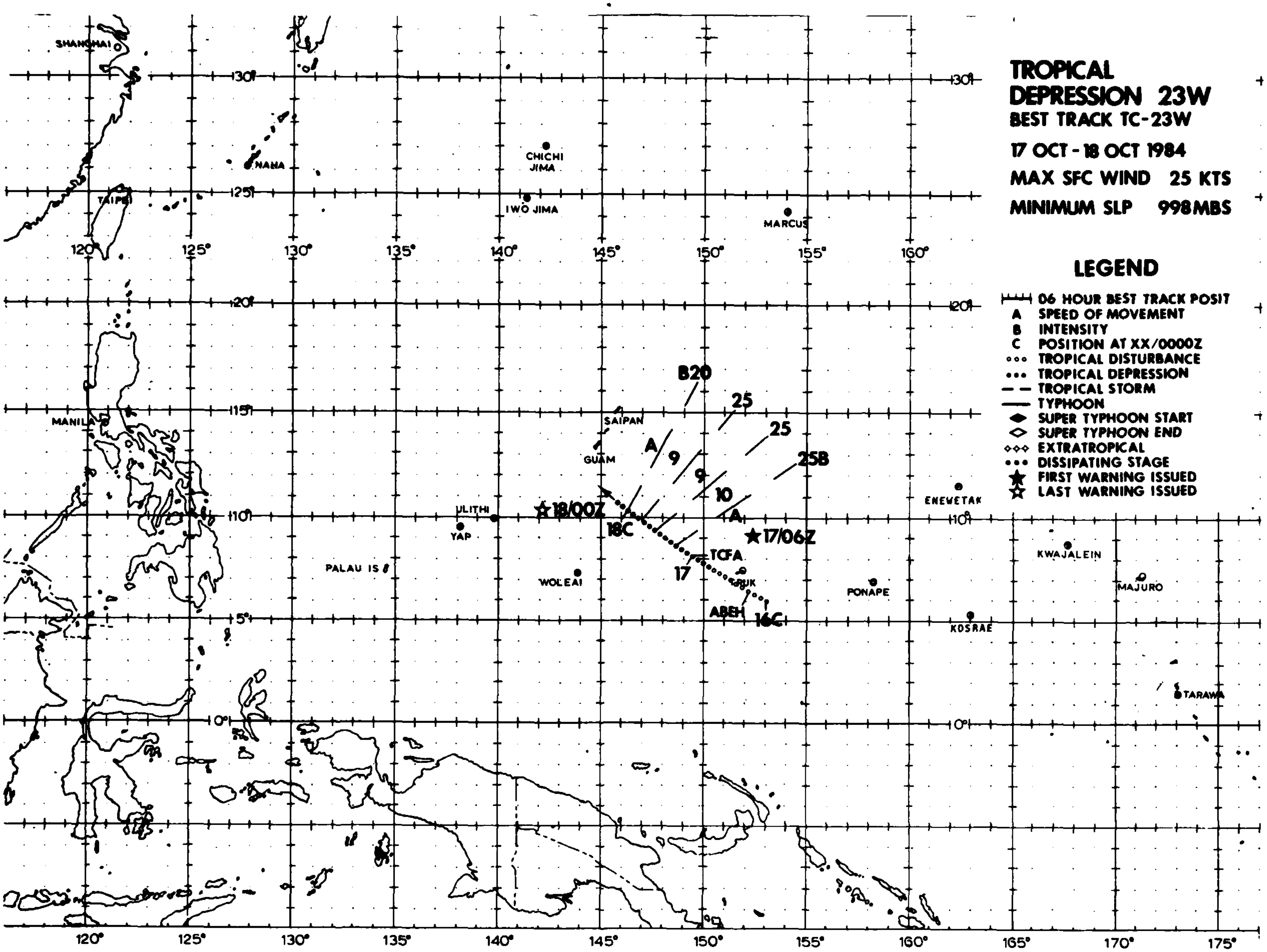


Figure 3-22-2. The 110000Z October 200 mb analysis. The upper-level anticyclone over the South China Sea is an independent system. It was not formed by the outflow pattern of the two tropical storms near Guam. (The 111200Z 200 mb analysis had insufficient data to conduct a meaningful analysis).

transited up the Mekong Valley. Even though Susan dissipated as a significant tropical cyclone at 130000Z, its remnants were still evident three days later as an area of convection just to the west of Hanoi (WMO 48820). Initial reports indicate 33 people were killed and some 68,000 families left homeless due to the heavy rains and floods which accompanied Susan. Thousands of hectares of ripening autumn rice were also reported destroyed.

In summary, although Susan was simultaneously active with three other tropical cyclones, analysis proves that it was not a sympathetic storm induced by the inflow/outflow patterns of its companions. Susan started as a very broad system embedded in the monsoon trough and stayed in the axis of the through as it moved inland over Vietnam. Once over land it recurved to the north but was identifiable for several more days.

Figure 3-22-3. Tropical Storm Susan near maximum intensity. The storm made landfall over coastal Vietnam two hours later (120822Z October NOAA visual imagery).


TROPICAL DEPRESSION 23W
BEST TRACK TC-23W
17 OCT - 18 OCT 1984
MAX SFC WIND 25 KTS
MINIMUM SLP 998MBS
LEGEND
06 HOUR BEST TRACK POSIT
A SPEED OF MOVEMENT
B INTENSITY
C POSITION AT XX/0000Z
TROPICAL DISTURBANCE
TROPICAL DEPRESSION
TROPICAL STORM
TYPHOON
SUPER TYPHOON START
SUPER TYPHOON END
EXTRATROPICAL
DISSIPATING STAGE
FIRST WARNING ISSUED
LAST WARNING ISSUED
SHANGHAI
NAHA
TAIPEI
MANILA
CHICHI JIMA
IWO JIMA
MARCUS
SAIPAN
GUAM
ULITHI
YAP
PALAU IS
WOLEAI
TRUK
PONAPE
ENEWETAK
KWAJALEIN
MAJURO
KOSRAE
TARAWA
18/00Z
17/06Z
TCFA
ABEH
B20
25
25
25B
A
9
9
10
A
18C
17
16C
120°
125°
130°
135°
140°
145°
150°
155°
160°
165°
170°
175°
30°
25°
20°
15°
10°
5°
0°

TROPICAL DEPRESSION (23W)

Tropical Depression 23W was a short-lived system which developed in the monsoon trough. The lack of upper-level support resulted in dissipation only 18 hours after it became a significant tropical cyclone.

After the dissipation of Typhoon Phyllis on 14 October, the low-level monsoon trough still extended from Southeast Asia to the Marshall Islands. At 150000Z, the upper-level wind-flow was similar to the pattern present several days earlier, with a large anticyclone located near Marcus Island (Minami Tori-Shima (WMO 47991)). In addition, a westward moving TUTT cell was now located near 18N 172E. At this time the convection associated with the monsoon trough showed little organization. Upper-level flow over the area was generally easterly, with northeast flow inhibiting convective development along the northern side of the low-level trough.

Early on the 16th, the convection began to show signs of increased organization. This was especially evident near the island of Truk (WMO 91334), where the eastward extension of the monsoon trough and the strongest low-level cyclonic turning were located. Synoptic data at this time indicated a 1005 mb surface circulation was present. The Significant Tropical Weather Advisory (ABEH PGTW) at 160600Z mentioned this area as having a "fair" potential for significant tropical cyclone development.

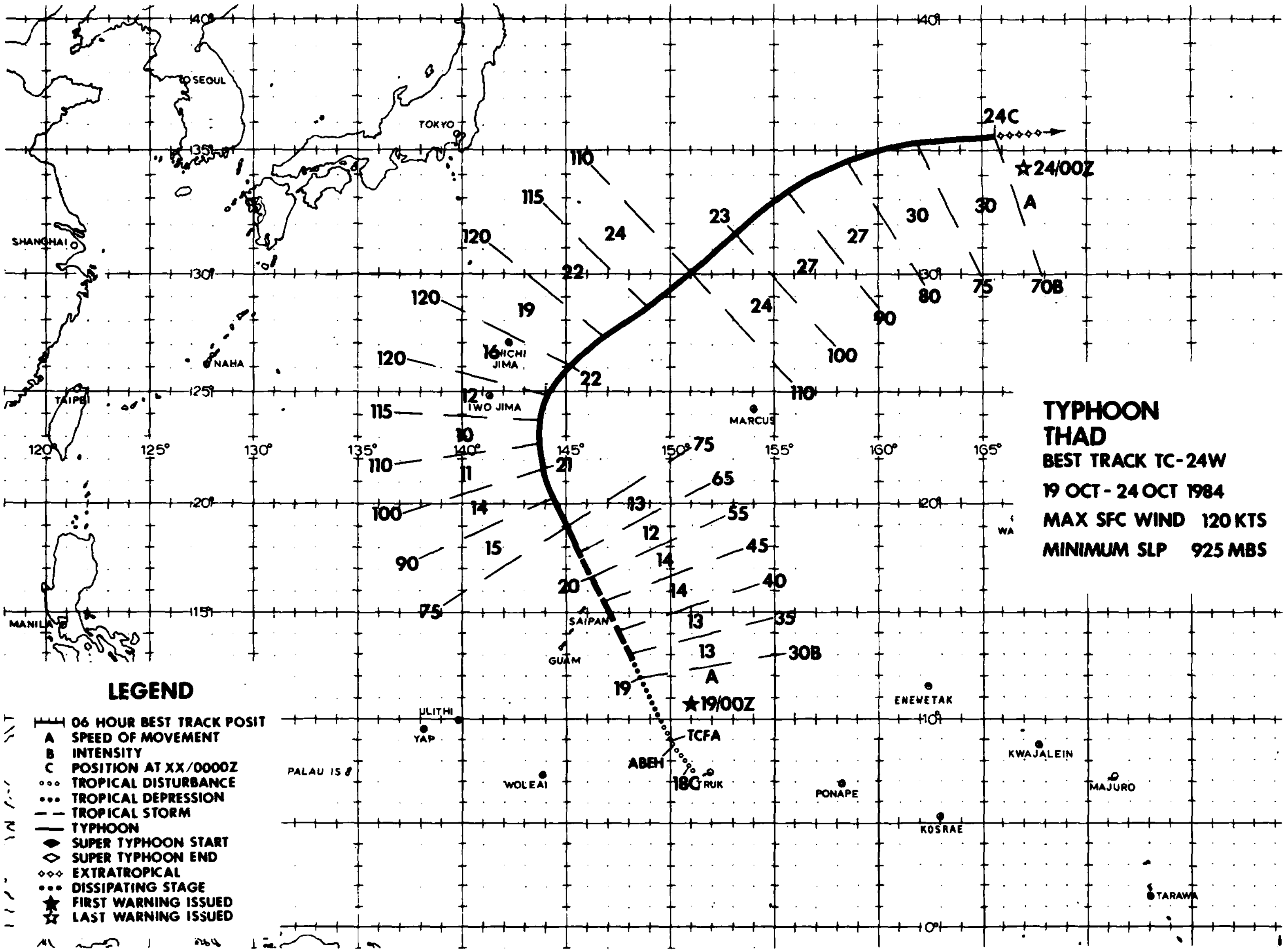
Satellite imagery during the next 18 hours showed the convection had become more organized with the development of a central convective feature. Synoptic data revealed sea-level pressures of 1003 mb to 1006 mb around the periphery of the circulation with the central pressure estimated to be near 1000 mb. These developments prompted the issuance of a TCFA at 170000Z. Upper-level data indicated the flow was now slightly diffluent as the disturbance was located in the TUTT axis.

An investigative reconnaissance flight into the disturbance closed-off a surface circulation at 170600Z and reported maximum surface winds of 25 kt (13 m/s). The MSLP had decreased to 998 mb. Since further development was expected, the first warning on Tropical Depression 23W valid at 170600Z was issued a short time later (Figure 3-23-1).

During the next 18 hours, Tropical Depression 23W moved northwest and weakened rather than intensified. Aircraft reconnaissance at 172030Z could not locate a surface circulation, but instead observed winds which indicated that a much larger circulation was developing to the southeast. Consequently, the final warning on the dissipated Tropical Depression 23W was issued at 180000Z.

Post-analysis indicates that Tropical Depression 23W dissipated as a result of unfavorable upper-level support. As the poorly organized depression moved west-northwest along the northern periphery of the low-level monsoon trough, it moved into an area of 30 to 40 kt (15 to 21 m/s) northerly upper-level winds from the combined effects of the anticyclone (now located near Iwo Jima (WMO 47981)) and the TUTT cell to the northeast. The strong wind shear over the depression created an environment which was unfavorable for tropical cyclone development. In comparison, the area southeast of Tropical Depression 23W was located in a region of diffluent flow with the upper-level TUTT cell to the northeast enhancing the diffluence. Satellite imagery reflected this favorable upper-level outflow as much stronger convection was forming in this area. This area of convection would soon develop into Typhoon Thad.

Figure 3-23-1. Tropical Depression 23W at the time the first warning was issued. A TUTT cell is located northeast of the depression (170537Z October NOAA visual imagery).


TYPHOON
THAD
BEST TRACK TC-24W
19 OCT - 24 OCT 1984
MAX SFC WIND 120 KTS
MINIMUM SLP 925 MBS
LEGEND
06 HOUR BEST TRACK POSIT
A SPEED OF MOVEMENT
B INTENSITY
C POSITION AT XX/0000Z
TROPICAL DISTURBANCE
TROPICAL DEPRESSION
TROPICAL STORM
TYPHOON
SUPER TYPHOON START
SUPER TYPHOON END
EXTRATROPICAL
DISSIPATING STAGE
FIRST WARNING ISSUED
LAST WARNING ISSUED
24C
24/00Z
19/00Z
TCFA
ABEH
18C
SEOUL
TOKYO
SHANGHAI
NAHA
TAIPEI
MANILA
CHICHI JIMA
IWO JIMA
MARCUS
SAIPAN
GUAM
ULITHI
YAP
PALAU IS
WOLEAI
TRUK
PONAPE
ENEWETAK
KOSRAE
KWAJALEIN
MAJURO
TARAWA

TYPHOON THAD (24W)

Typhoon Thad developed southeast of Guam just as Tropical Depression 23W was dissipating several hundred miles to the northwest. Unlike its predecessor, Thad developed under favorable upper-level environment which permitted further intensification. As Thad developed, it tracked steadily to the north-northwest before recurving to the northeast. The typhoon's movement was well forecast except during the initial stages.

Late on 17 October, satellite imagery revealed that an area of strong convection was developing a few hundred miles southeast of the short-lived Tropical Depression 23W. The development of the convection was aided significantly by the presence of a weakening TUTT cell to the north-northeast which provided strong diffluence aloft over the convection.

Synoptic data at 180000Z confirmed what the last aircraft reconnaissance mission into Tropical Depression 23W had observed a few hours earlier; that a broad surface circulation was developing near Truk (WMO 91334). This circulation was underneath the developing convection and on the eastern end of the monsoon trough. Synoptic data south of the trough axis indicated the southwest monsoon was reintensifying with numerous 20 to 30 kt (10 to 15 m/s) west winds being reported.

Over the next several hours, the convection rapidly consolidated. In addition, satellite imagery and synoptic data showed an anticyclone was developing aloft providing good outflow to all quadrants. As a result, a TCFA was issued at 180630Z.

During the next 18 hours satellite imagery indicated the disturbance was moving northwest towards Guam. With Dvorak intensity analysis indicating 30 kt (15 m/s) surface winds present and 45 kt (23 m/s) surface winds forecast in 24 hours, the first warning on Thad was issued at 190000Z.

The initial warning forecast Thad to continue to move to the northwest, pass just south of Guam and gradually turn towards the west-northwest in the 48 to 72 hour period. This forecast was in good agreement with all JTWC forecast aids. Also the NOGAPS analysis and prog series indicated the subtropical ridge had returned closer to its climatological position north of Guam which further convinced JTWC that this track was reasonable.

As it turned out, this forecast would be wrong for two reasons. First, JTWC did not accurately know where the low-level center was located. Second, and more importantly, the subtropical ridge was not nearly as strong nor as far west as indicated in the analysis and prog series. Between 190000Z and 190600Z, as Thad supposedly neared Guam (WMO 91212), the winds on the island should have veered to the east or southeast. Instead, they remained from the northeast. But analysis of satellite imagery indicated that Thad was heading directly towards Guam. Clearly something was amiss! JTWC's efforts to locate the surface center were further hampered by maintenance problems which prevented reconnaissance aircraft from penetrating the disturbances center.

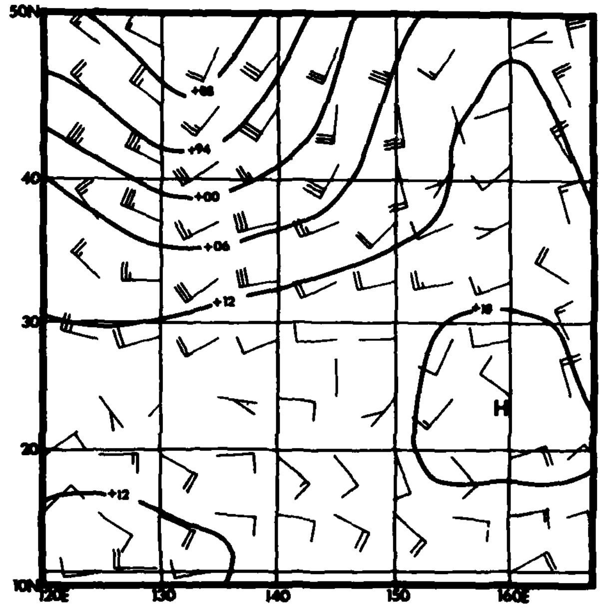
At 190728Z the first aircraft reconnaissance flight into the center of the disturbance was finally made and quickly settled the discrepency. It located Thad almost 180 nm (333 km) east of Guam with an MSLP of 990 mb. As a result, the 190600Z warning position relocated Thad some 120 nm (222 km) to the northeast! This meant that the storm would now safely clear Guam.

At 200000Z, as a now well-developed Thad continued to move to the north-northwest at 13 to 14 kt (24 to 26 km/hr), it became obvious the storm was not going to turn towards the west. Clearly the subtropical ridge was not as well-established nor as far west as the NOGAPS progs had earlier indicated (Figure 3-24-1). JTWC now forecast continued north-northwest movement for the next 24 hours with recurvature to the northeast between 210000Z and 220000Z due to the approach of a mid-latitude trough. As it turned out, this forecast track was excellent, with the speeds of movement after recurvature being only slightly faster than anticipated.

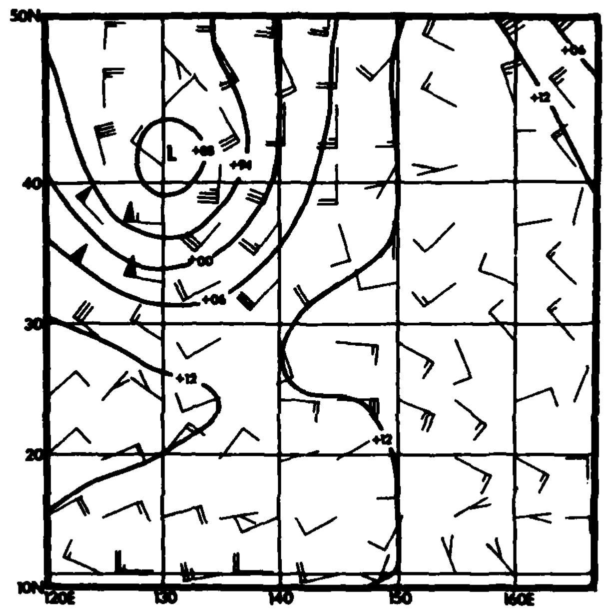
Thad intensified steadily from the time JTWC went into warning status at 190000Z, until it reached its peak intensity of 120 kt (62 m/s) at 211800Z (Figure 3-24-2). By this time Thad had begun to recurve and link-up with a mid-latitude trough. After maintaining the 120 kt (62 m/s) intensity for approximately 12 hours, Thad began a slow weakening trend which continued until the storm went extratropical. During this period, Thad accelerated from 16 to 30 kt (30 to 56 km/hr) as it became embedded in the westerlies. As would be expected with the storms that accelerate after recurvature, the strongest surface winds were consistently observed in the southeast semicircle.

As Thad accelerated to the northeast, strong upper-level westerlies began to displace the upper-level circulation and convection from the surface center. This was confirmed by the 222310Z aircraft reconnaissance fix which found the 700 mb center 28 nm (52 km) east-northeast of the surface center. All significant convection was now located north of the surface center.

On the 23rd, Thad lost most of its convection with an exposed low-level circulation center visible on satellite imagery. The final warning on this system was issued by JTWC at 240000Z. Future warnings on the extratropical low were contained in NAVOCEANCOMCEN GUAM extratropical wind warning bulletins (WWPN PGFW).



NOGAPS 700 mb 48-hour prog VT: 201200Z October



201200Z October 700 mb NOGAPS analysis

Figure 3-24-1. Comparison of the 48 hour 700 mb NOGAPS prog available to the TDO when the first warning was issued and the verifying analysis. The western extension of the subtropical ridge was forecast to extend west along 26N to near 130E. Instead, due to the effects of a digging mid-latitude trough moving into the Sea of Japan, the ridge slid east which allowed Thad to rapidly recurve to the northeast.

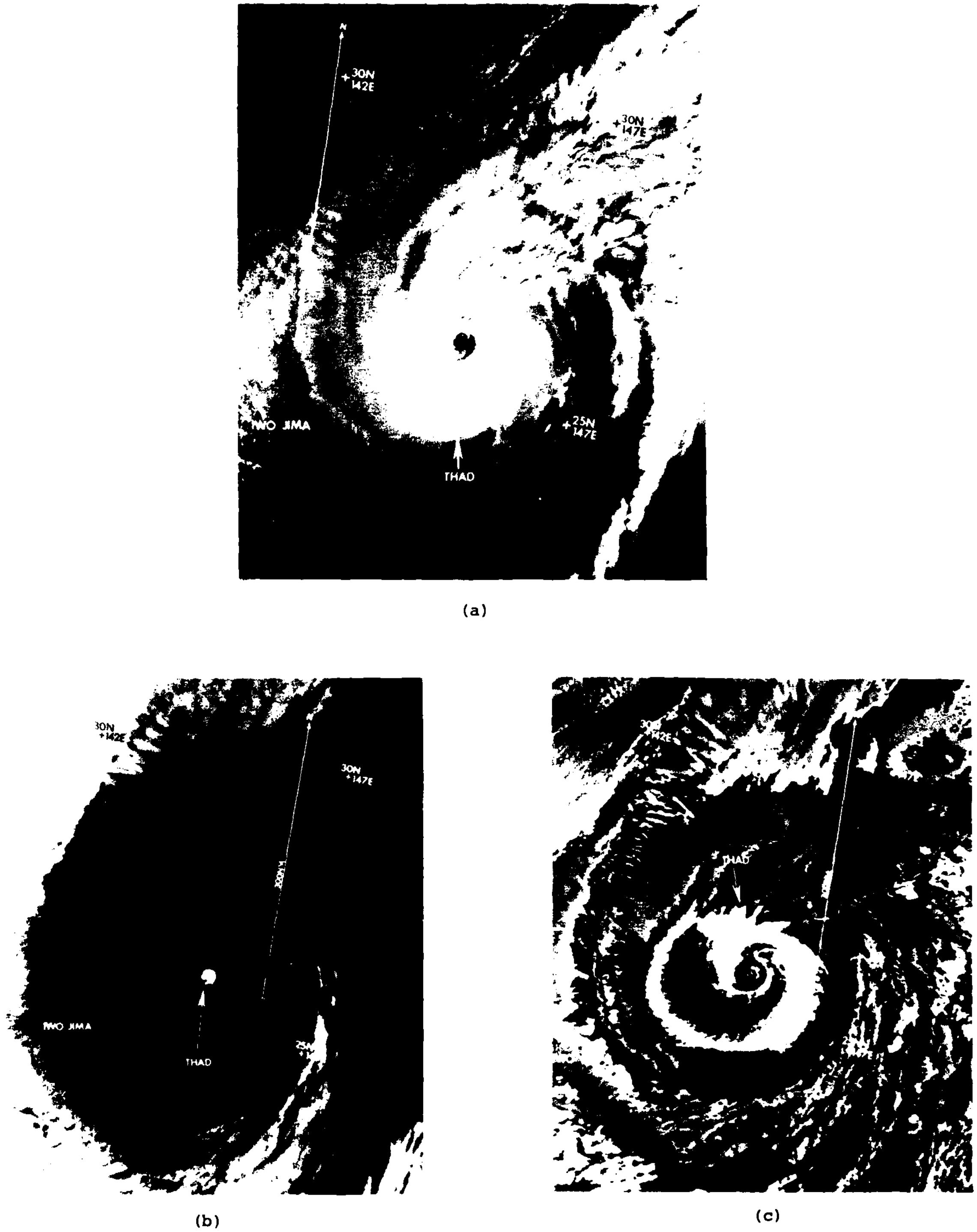
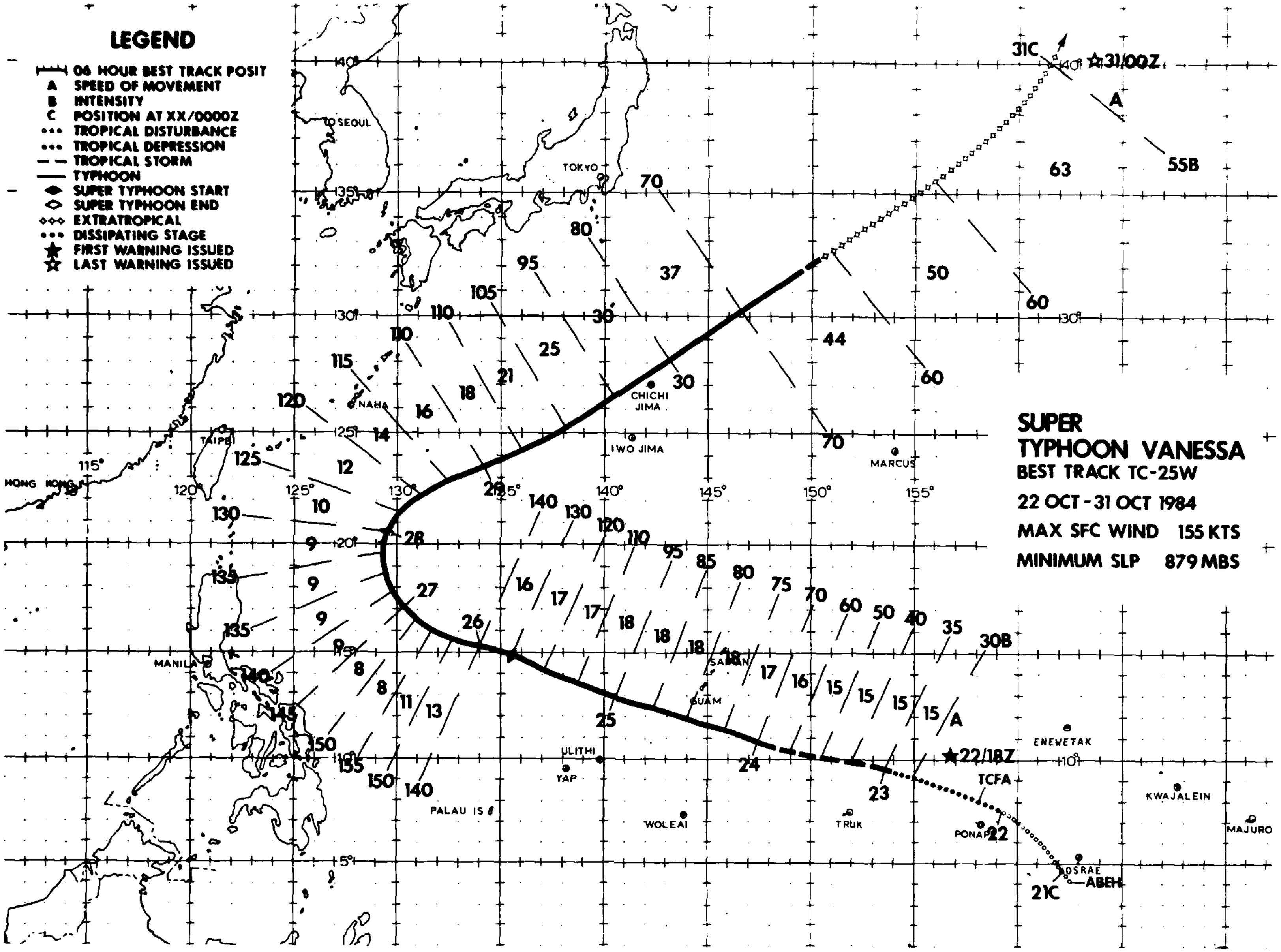


Figure 3-24-2. Three views of Typhoon Thad at maximum intensity: (a) Visual imagery (b) Infrared imagery and (c) Enhanced Infrared imagery - Dvorak Tropical Cyclone Curve. (220002Z October DMSP imagery).


LEGEND
06 HOUR BEST TRACK POSIT
A SPEED OF MOVEMENT
B INTENSITY
C POSITION AT XX/0000Z
TROPICAL DISTURBANCE
TROPICAL DEPRESSION
TROPICAL STORM
TYPHOON
SUPER TYPHOON START
SUPER TYPHOON END
EXTRATROPICAL
DISSIPATING STAGE
FIRST WARNING ISSUED
LAST WARNING ISSUED
SUPER
TYPHOON VANESSA
BEST TRACK TC-25W
22 OCT - 31 OCT 1984
MAX SFC WIND 155 KTS
MINIMUM SLP 879 MBS
31C
31/00Z
A
55B
63
22/18Z
TCFA
21C
ABEH
30B
SEOUL
TOKYO
HONG KONG
TAIPEI
NAHA
MANILA
CHICHI JIMA
IWO JIMA
MARCUS
SAIPAN
GUAM
ULITHI
YAP
PALAU IS
WOLEAI
TRUK
PONAPE
KOSRAE
ENEWETAK
KWAJALEIN
MAJURO

SUPER TYPHOON VANESSA (25W)

Super Typhoon Vanessa, the first super typhoon of the 1984 season, also developed into the most intense storm of the year. At peak intensity Vanessa had an MSLP of 879 mb, only 9 mb above the record 870 mb observed in Super Typhoon Tip (1979). Except for a brief period when the storm brushed Guam, Vanessa remained clear of land and generally posed a threat only to shipping.

Super Typhoon Vanessa originated in the Near Equatorial Trough southeast of Ponape (WMO 91348) three days after Typhoon Thad formed some 700 nm (1296 km) further to the west. The disturbance was initially detected on 20 October as an area of convection near 4N 163E. Its rapid development resulted in the Significant Tropical Weather Advisory (ABEH PGTW) being reissued at 201900Z to include this area of convection as a suspect disturbance.

During the 21st and into the 22nd, the area of convection slowly increased in organization as the disturbance moved northwest to just north of Ponape. The persistent improvement in organization during this period resulted in the issuance of a TCFA at 220500Z. Sparse synoptic data at the time of the TCFA was only able to confirm the presence of a 10 to 15 kt (5 to 8 m/s) surface circulation. By now an upper-level anticyclone had developed, providing good outflow to all but the northwest quadrant which was still feeling some effects from the outflow of Typhoon Thad. The first warning on Vanessa was issued at 221800Z when analysis of satellite imagery resulted in an estimate that the disturbance now supported surface winds of 35 kt (18 m/s).

From beginning to end, Vanessa followed a very climatological track becoming one of the "great-recurver" storms of 1984. From the time it attained depression strength until it began to recurve, it moved almost due west-northwest. After recurving south of Okinawa, Vanessa underwent a complex transition into an extratropical low east of Japan.

Vanessa's intensity came very close to equalling the records established by Super Typhoon Tip in 1979. Figure 3-25-1 shows the MSLP versus time for Vanessa as obtained by reconnaissance aircraft. The pressure dropped 100 mb in a 48 hour period to reach a minimum of 879 mb at 261114Z. This is only 9 mb higher than the 870 mb recorded in Tip. (These pressures convert to 155 kt (80 m/s) and approximately 165 kt (85 m/s) for Vanessa and Tip, respectively, using the Atkinson and Holliday (1977) pressure-wind relationship).

The initial warning forecast Vanessa to move west-northwest and pass over Guam within 48 hours as a 65 kt (33 m/s) typhoon. The accuracy of the first forecasts gave the military and civilian communities on Guam sufficient time to properly prepare. Consequently there was little structural damage on the island and no personal injuries when Vanessa did approach as an 80 kt (41 m/s) typhoon. Vanessa's closest point of approach to Guam was 90 nm (167 km) to the south-southwest at 241100Z. Sustained winds above 30 kt (15 m/s) were recorded at numerous locations on the island with a peak gust of 59 kt (30 m/s) recorded at the Naval Oceanography Command Center (NAVOCEANCOMCEN) building on Nimitz Hill.

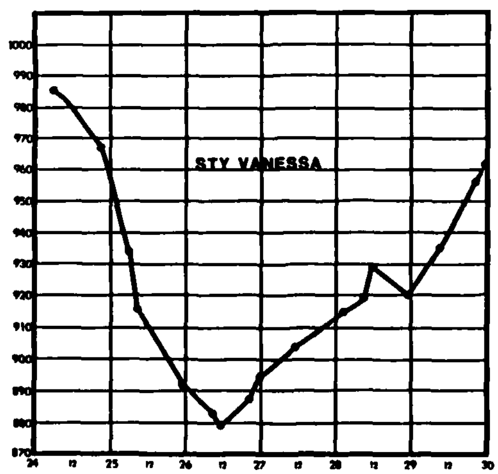


Figure 3-25-1. Time cross-section of Vanessa's minimum sea-level pressure as measured by reconnaissance aircraft. The pressure dropped 100 mb in a 48 hour period reaching a low of 879 mb at 261114Z. This is only 9 mb higher than the record 870 mb observed in Super Typhoon Tip in 1979.

Figure 3-25-2. Super Typhoon Vanessa near maximum intensity (252233Z October NOAA visual imagery).

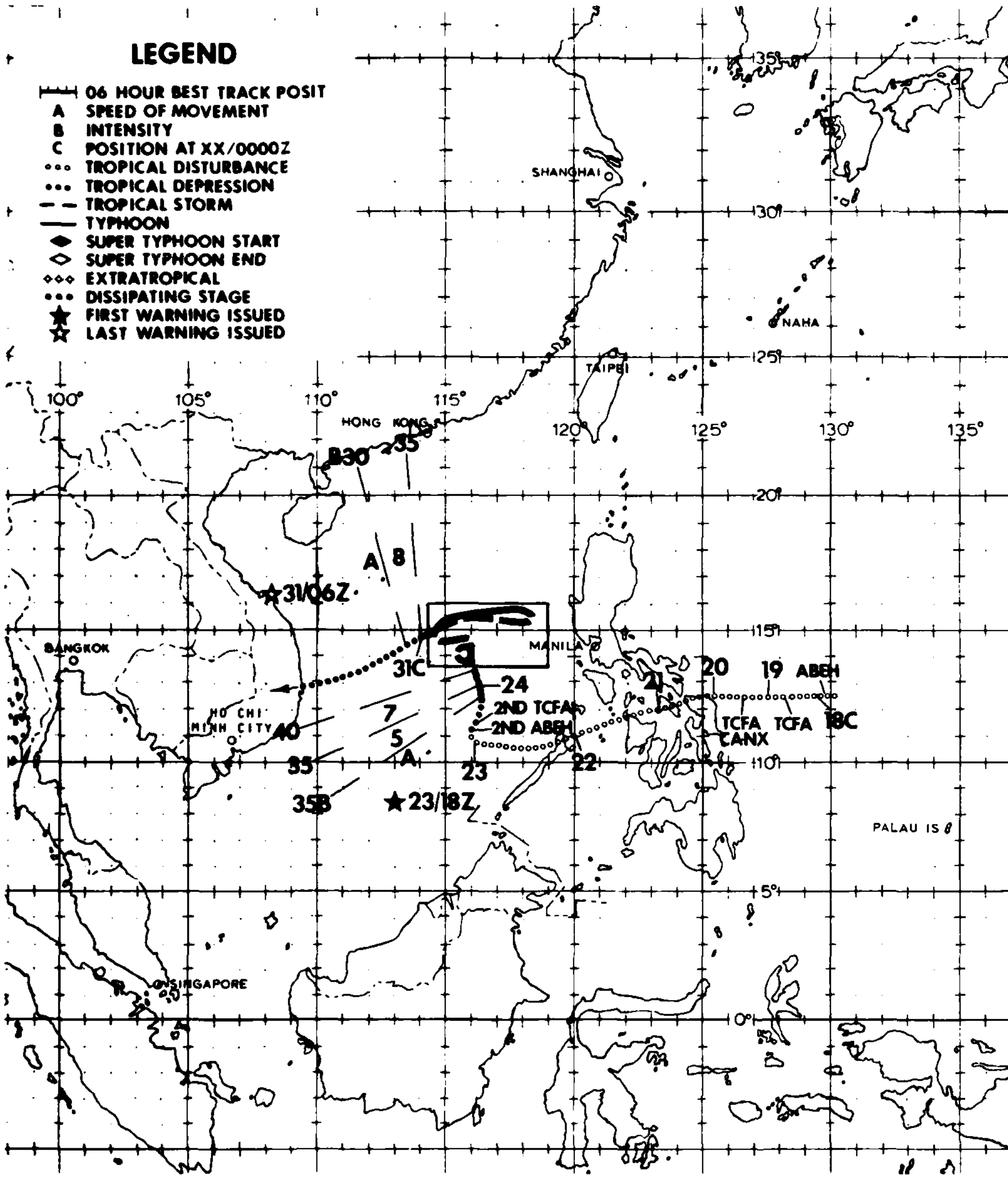
The only significant damage on Guam occurred to vegetation. An estimated 1.7 million dollars worth of crops were lost, principally bananas. Flooding was also reported in the southern coastal areas of the island.

Vanessa continued to intensify and move west-northwest after it passed south of Guam. The dominate synoptic feature was the subtropical ridge north of Vanessa which redeveloped in the wake of Typhoon Thad. Vanessa moved along the southern side of the ridge for nearly five days before recurving. It was just prior to recurvature, at 261200Z that a peak intensity of 155 kt (80 m/s) was attained (Figure 3-25-2). The ARWO flying the 261114Z fix mission that observed the 879 mb MSLP, described the 10 nm (19 km) circular eye as exhibiting a "fishbowl effect" with the convection in the eyewall spiralling vertically to the point of resembling corkscrews. During this flight, at a 700 mb height of 2022 m, the 700 mb temperature within the eye was an exceptionally high 30°C. Vanessa remained a super typhoon from 251800Z to 280000Z.

The recurvature which eventually took place on the 27th and 28th was initially forecast on the 250000Z warning. A frontal system over eastern China was identified as the mechanism for recurvature. Vanessa was forecast to recurve at 21N to 22N, but actually turned to the northeast at 20N as the frontal system moved slightly faster than predicted. At no point during this period was Typhoon Warren in the South China Sea considered to be a factor in Vanessa's movement since Vanessa was the dominant storm both in size and strength.

The final phase of Vanessa's life was a complex transition to an extratropical low. Interaction with the front began shortly after recurvature. The 282330Z aircraft reconnaissance mission indicated the transition was underway with stratocumulus undercast present throughout much of the storm. Vanessa continued to weaken until the transition was complete.

Post-analysis indicates that extratropical transition was completed by 301200Z as satellite imagery showed no convection was present. Vanessa transitioned to a storm force low along the front and rapidly moved off to the northeast. The final warning was issued at 310000Z.



TYPHOON WARREN

BEST TRACK TC-26W

23 OCT - 31 OCT 1984

MAX SFC WIND 65 KTS

MINIMUM SLP 976 MBS

DTG	SPEED	INTENSITY	DTG	SPEED	INTENSITY
2406Z	7	40	2718Z	7	65
2412Z	4	45	2800Z	7	65
2418Z	5	50	2806Z	4	65
2500Z	5	50	2812Z	2	65
2506Z	4	55	2818Z	2	65
2512Z	6	55	2900Z	4	60
2518Z	5	60	2906Z	4	55
2600Z	3	60	2912Z	4	55
2606Z	2	65	2918Z	3	50
2612Z	0	65	3000Z	4	45
2618Z	0	65	3006Z	7	45
2700Z	4	65	3012Z	7	40
2706Z	7	65	3018Z	8	40
2712Z	7	65	3100Z		35

Typhoon Warren was the most erratic moving tropical cyclone of 1984. The system was the subject of two TCFAs. It made both a cyclonic and anticyclonic loop and varied in speed from quasi-stationary for 12 hours to 8 kt (15 m/s). Warren's erratic movements were due to interactions with eastward moving mid-latitude troughs and Super Typhoon Vanessa and due to its location in the monsoon trough.

The precursor of Warren appeared late on 17 October as an area of poorly organized convection at the trailing end of a shear line approximately 300 nm (556 km) northeast of Mindanao. Synoptic data at the time indicated that a broad 15 to 25 kt (8 to 13 m/s) circulation was collocated with the convection and embedded in the monsoon trough. Over the next 24 hours the convection persisted and appeared to be separating from the shear zone while increasing slightly in organization and intensity. This prompted the first TCFA to be issued at 181500Z. Aircraft reconnaissance investigated the alert area at 190159Z and found a broad weak surface circulation with an MSLP of 1006 mb. Satellite imagery now showed the convection to be decreasing which was confirmed by the ARWO who reported that no significant convection was directly associated with the disturbance. The TCFA was cancelled at 191130Z based on the lack of persistent significant convection near the low-level center, strong upper-level easterly winds over the region, and the proximity of the disturbance to land.

Over the next several days the surface circulation weakened and moved west-southwest along the trough axis across the Philippines and entered the South China Sea on 22 October. During this period synoptic data indicated that several weak circulations were embedded in the monsoon trough. Late on 22 October the tropospheric pattern became more favorable for development. Synoptic data showed that west of Palawan a strong northeast monsoon outbreak combined with a moderate southwest monsoon to the south had produced a well-defined surface circulation. Meanwhile, upper-level diffluence developed over the South China Sea on the western edge of an anticyclone located east of Luzon (Figure 3-26-1).

On 23 October the disturbance rapidly developed. Satellite imagery at 230300Z showed that an exposed low-level circulation center was present some 30 to 60 nm (56 to 111 km) southeast of the developing intense convection. Satellite data also indicated that the tightly wrapped surface circulation was moving north towards the convection. The 30 to 40 kt (15 to 21 m/s) east-southeast upper-level wind over the disturbance, while providing some diffluence, which contributed towards development, also hindered the surface circulation from aligning with the convection. At 230600Z the disturbance was again mentioned on the ABEH, followed several hours later by the second TCFA at 231100Z. With continued development evident, the first warning was issued at 1800Z. Infrared satellite imagery at the time of the first warning indicated the surface center was now located on the eastern edge of the Central Dense Overcast (CDO). Although Dvorak satellite intensity analysis on the 231800Z infrared imagery indicated that 35 kt (18 m/s) winds were present, JTWC did not upgrade Warren from

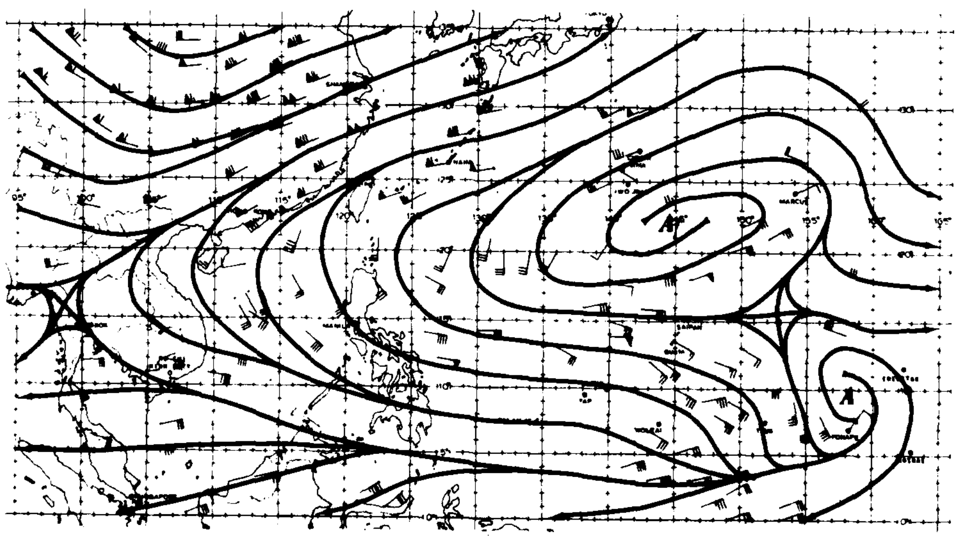


Figure 3-26-1. 200 mb analysis at 230000Z October. The diffluence over the South China Sea was sufficient to allow Warren to develop, although it would later hinder the low-level circulation from becoming collocated with the convection.

depression status until 12 hours later when visual imagery confirmed that the upgrade was warranted. Post analysis indicates this upgrade should have occurred at 231800Z. Warren and the monsoon trough moved north over the next 18 hours. Visual satellite imagery showed that a partially exposed low-level circulation center was now evident on the northeast edge of the convection.

Between 240600Z and 270000Z Warren moved erratically. It did a small cyclonic loop on the 24th and 25th, before resuming a slow westward course followed by a turn to the north and a 12-hour quasi-stationary period between 261200Z and 270000Z. This erratic movement was partially due to Warren's remaining embedded in the monsoon trough and the passage of a mid-latitude trough to the north.

During this period, despite the strong upper-level easterly winds which kept nearly all the convection west of the low-level center, Warren strengthened to typhoon intensity. Aircraft reconnaissance at 260330Z found a band of 60 to 70 kt (31 to 36 m/s) surface winds in the south semicircle of Warren. These winds were the result of the southwest monsoon enhancing Warren's circulation. Warren maintained this minimum 65 kt (33 m/s) typhoon intensity through 281800Z.

Warren became quasi-stationary at 261200Z. At this time Super Typhoon Vanessa (located some 960 nm (1778 km) to the east of Warren in the central Philippine Sea) was moving towards the northwest. Warren now came under the influence of Vanessa's large inflow and a mid-latitude trough passing to the north. (This trough would also be responsible for Vanessa's recurvature). Warren responded by turning to the east-northeast and accelerating to 7 kt (13 km/hr) (Figure 3-26-2). This placed the Philippine Islands north of 14N including Clark AB and the Subic Bay Naval Facilities in imminent danger of being hit by Warren. As a result, all Navy and Air Force Bases in the region were placed in Condition of Readiness I early on the 28th. Fortunately, Warren's interaction with Vanessa and the mid-latitude trough was short-lived sparing the Philippines a direct hit. On 28 October, with Vanessa recurving and the trough axis to the east, Warren slowed and commenced an anticyclonic turn back to the west. At its closest point of approach, Warren was 120 nm (222 km) west-northwest of Clark AB (WMO 98327). As the effects of the trough and Vanessa eased, Warren completed its turn to the west on 29 October. The highest wind reported at Clark AB was 22 kt (11 m/s) at 282055Z, with the total rainfall on 28 and 29 October reaching 8.74 inches (222 mm). No significant damage was reported at any of the military bases.

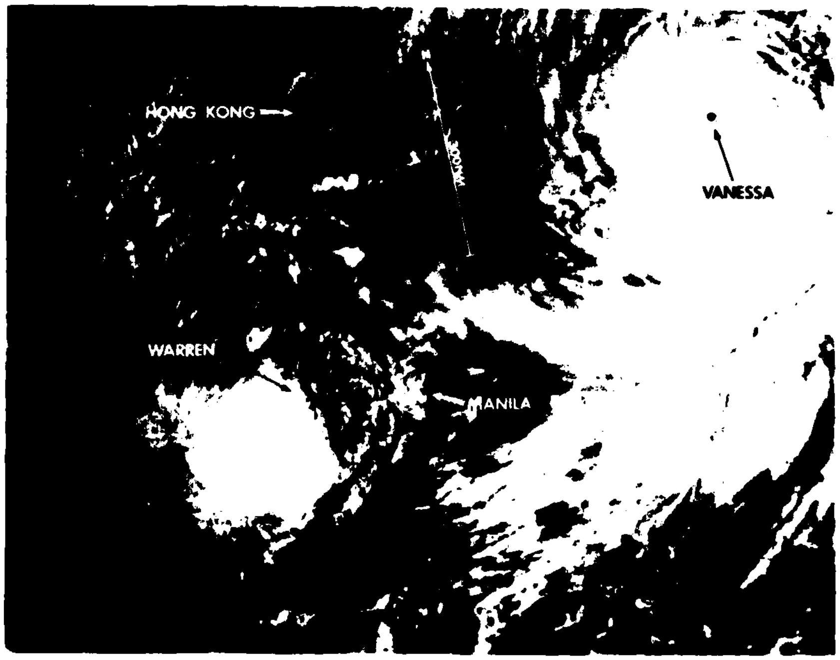


Figure 3-26-2. Typhoon Warren as it moved to the east-northeast under the influence of Super Typhoon Vanessa. Note the effects of the strong upper-level outflow from Vanessa displacing Warren's convection to the west (272326Z October NOAA visual imagery).

Other coastal areas and marine interests were not nearly as fortunate. Heavy rains caused landslides in several coastal towns killing at least 42 people. High seas capsized and sank the inter-island passenger ferry, MV VENUS (746 tons) on 28 October off Torrijos and Bondoc Peninsula. About 36 people were killed but at least 213 passengers were saved. In addition, a 930 ton ship, the Lorenzo Container VIII was sunk on 28 October near 14.0N 120.6E, with eight crew members listed as missing.

Ridging developed in the low to mid-levels in wake of the mid-latitude trough passage. The subtropical ridge now became anchored across the northern part of the South China Sea. Another surge of the northeast monsoon entered the South China Sea on 29 October and began to expand Warren's wind radii in the northern semicircle. Aircraft data indicated that Warren was beginning to weaken as it drew cooler, dryer air into its center. The ARWO reported that the center was surrounded by stratocumulus clouds. This was also evident on satellite imagery as the convection began to decrease in intensity. The deep-layered northeast monsoon flow pushed Warren's low-level circulation to the west-southwest on 30 October and created a significant tilt from the surface to the 700 mb center. On the 31st, the hard convection was associated with the 700 mb center, displaced approximately 60 nm (111 km) west-northwest of the weakening surface center (Figure 3-26-3). JTWC issued the final warning at 310600Z since the 30 kt (15 m/s) surface center was no longer expected to become aligned with the mid-level center and the convection. This prognosis held true, but because Warren's low-level circulation was still in a region of positive low-level vorticity, dissipation occurred much slower than was forecast. Satellite imagery still showed that a well-defined low-level circulation was present 24 hours after the last warning was issued. Warren's displaced convection crossed the central Vietnam coast on 1 November with moderate to heavy rain forecast. The combination of the northeast monsoon and dissipating surface circulation just offshore resulted in 30 to 35 kt (15 to 18 m/s) winds along the Vietnam coast. By 1800Z on 1 November the surface circulation was no longer discernable on satellite imagery and synoptic data on 2 November was inconclusive as to the location of the weakening surface center. Warren had finally dissipated.

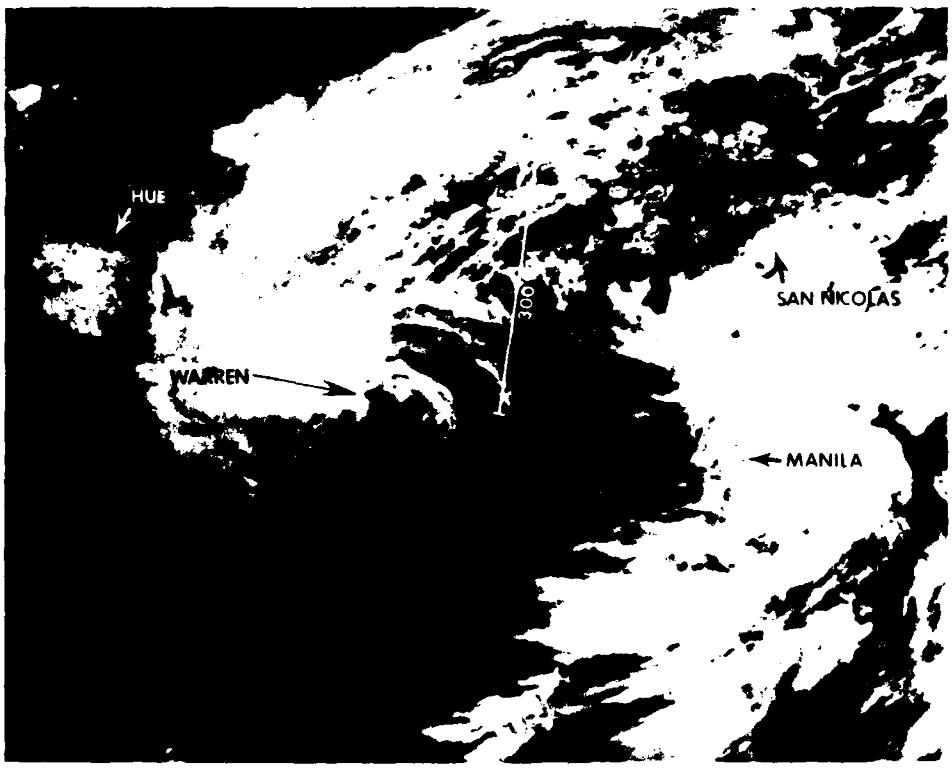
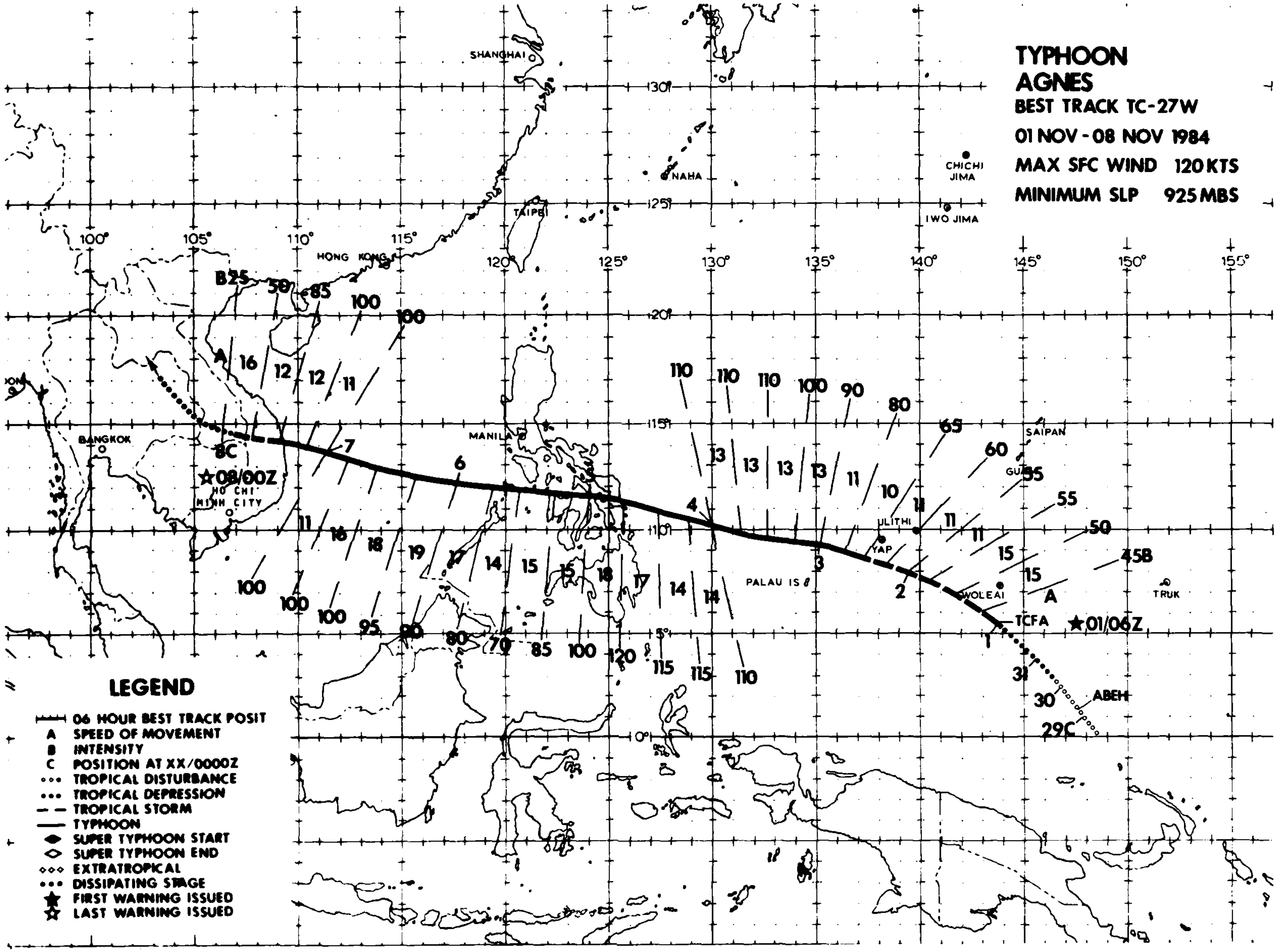


Figure 3-26-3. The partially exposed low-level circulation center displaced 60 to 70 nm (111 to 167 km) southeast of the 700 mb center. The northeast monsoon is pushing the low-level center to the southwest. This imagery was taken just four hours prior to the last warning (310204Z October DMSP visual imagery).


TYPHOON
AGNES
BEST TRACK TC-27W
01 NOV - 08 NOV 1984
MAX SFC WIND 120 KTS
MINIMUM SLP 925 MBS
SHANGHAI
NAHA
CHICHI JIMA
IWO JIMA
TAIPEI
HONG KONG
BANGKOK
HO CHI MINH CITY
MANILA
SAIPAN
GUAM
ULITHI
YAP
PALAU IS
WOLEAI
TRUK
ABEH
TCFA
★01/06Z
☆08/00Z
LEGEND
06 HOUR BEST TRACK POSIT
A SPEED OF MOVEMENT
B INTENSITY
C POSITION AT XX/0000Z
TROPICAL DISTURBANCE
TROPICAL DEPRESSION
TROPICAL STORM
TYPHOON
SUPER TYPHOON START
SUPER TYPHOON END
EXTRATROPICAL
DISSIPATING STAGE
FIRST WARNING ISSUED
LAST WARNING ISSUED

TYPHOON AGNES (27W)

Typhoon Agnes was the first of three tropical cyclones to develop during the month of November. It was also the last storm of the season to directly hit the Philippines. From the time of the first warning until it made landfall over central Vietnam, Agnes moved rapidly on a nearly straight west-northwest course.

The system that eventually developed into Typhoon Agnes began as an isolated area of weak convection near the equator on 28 October. Synoptic data at the time hinted that a weak 5 kt (3 m/s) surface circulation might be present beneath the convection near 1N 149E. The southwest monsoon at this time was restricted to the South China and northern Philippine Seas and did not assist in the development of this system. Even in its incipient stage, however, a small upper-level anticyclone was analyzed over the disturbance providing good ventilation.

The system slowly developed during the next three days as the area of convection and associated weak circulation moved northwest to near 4N. Late on the 31st, satellite imagery revealed that a significant increase in convection and organization was taking place. This prompted the issuance of a TCFA at 0000Z on 1 November.

During the next six hours the disturbance rapidly pulled itself together into a potent, compact circulation. The first aircraft reconnaissance mission into the alert area at 010513Z found a closed circulation with maximum surface winds of 50 kt (26 m/s). Analysis of satellite imagery conducted just prior to the flight had indicated that only 35 kt (18 m/s) winds were to be expected. The first warning on Agnes as a tropical storm was issued a short time later at 010600Z.

From the time the disturbance was initially detected until the TCFA was issued, Agnes had moved slowly to the northwest. By early on the 1st, Agnes had moved far enough north to be influenced by the easterly flow along the south side of the broad mid- to low-level subtropical ridge which now extended from the dateline west to the coast of Vietnam. This ridge and its associated easterly steering flow persisted throughout the life of Typhoon Agnes and kept the storm on a west-northwest track from the 1st of November until it dissipated over Vietnam six days later. This ridge was also responsible for making Agnes' wind field asymmetric. Due to the enhancement of the storm's circulation by the easterly trades, Agnes' wind field was consistently stronger and extended to a larger radii in the northern semicircle. This asymmetry would be present throughout much of the life of Agnes.

As Agnes transited the Philippine Sea it steadily intensified reaching a peak intensity of 120 kt (62 m/s) at 041800Z. This peak intensity occurred just prior to Agnes making landfall 10 nm (19 km) south of Borongan (WMO 98553) on the central Philippine Island of Samar. Figure 3-27-1 is satellite imagery of Agnes approximately twelve hours prior to reaching maximum intensity.

Agnes weakened as it crossed the central Philippines, but due to its rapid speed of movement was able to maintain typhoon intensity. After emerging in the South China Sea, Agnes once again intensified, this time to 100 kt (51 m/s). Agnes maintained this intensity until it made landfall 20 nm (37 km) north of Qui-Nhon, Vietnam (WMO 48870) at approximately 1100Z on 7 November (Figure 3-27-2). After landfall Agnes continued to track to the west-northwest and rapidly weakened. The final warning by JTWC was issued at 080000Z.

Typhoon Agnes caused substantial damage and loss of life when it crossed the Philippine Islands. Storm surge flooding of low-lying coastal areas on the islands of Samar and Leyte was particularly severe. In addition, heavy rainfall caused extensive flooding. The winds, floods and mudslides combined to leave over 350,000 homeless. At least 564 people are known dead as a result of the storm. When the number dead are combined with the number of people reported missing, the final death count is expected to be near 1000. News reports indicated that the damage exceeded 600 million pesos (30 million U.S. dollars).

When Typhoon Agnes made landfall on Vietnam three days later, there was additional destruction of property and loss of life. Heavy rains brought flooding which severely affected the rice harvest and winter crop cultivation.

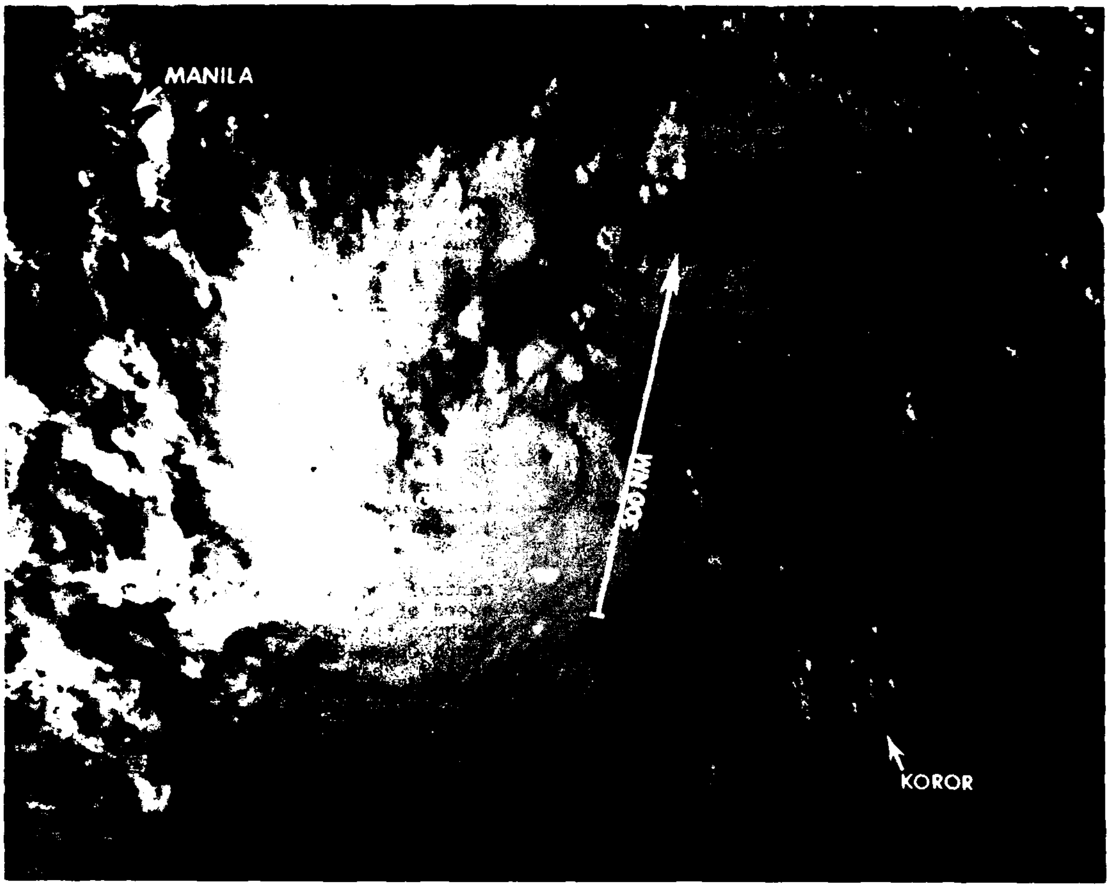


Figure 3-27-1. Agnes just prior to attaining peak intensity. At this time Agnes had a 5 nm (9 km) eye (040657Z November NOAA visual imagery).

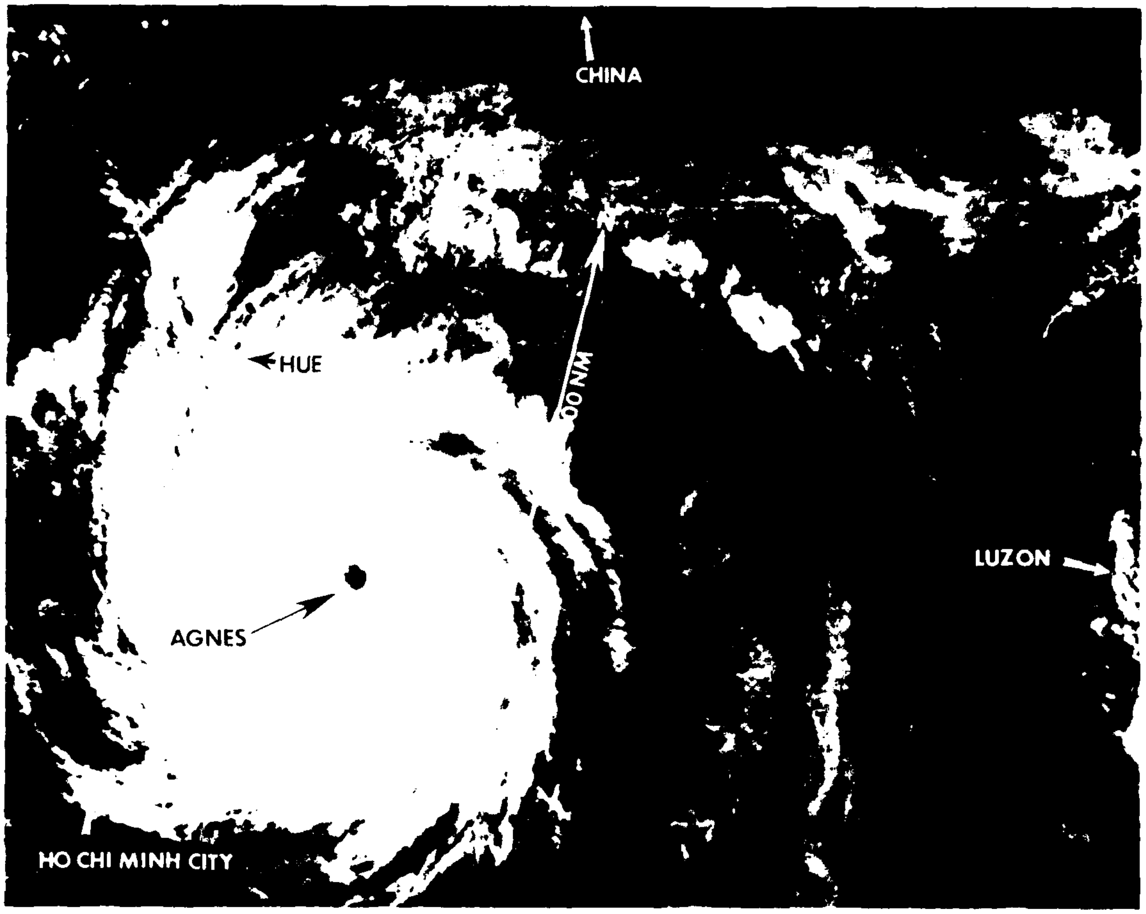
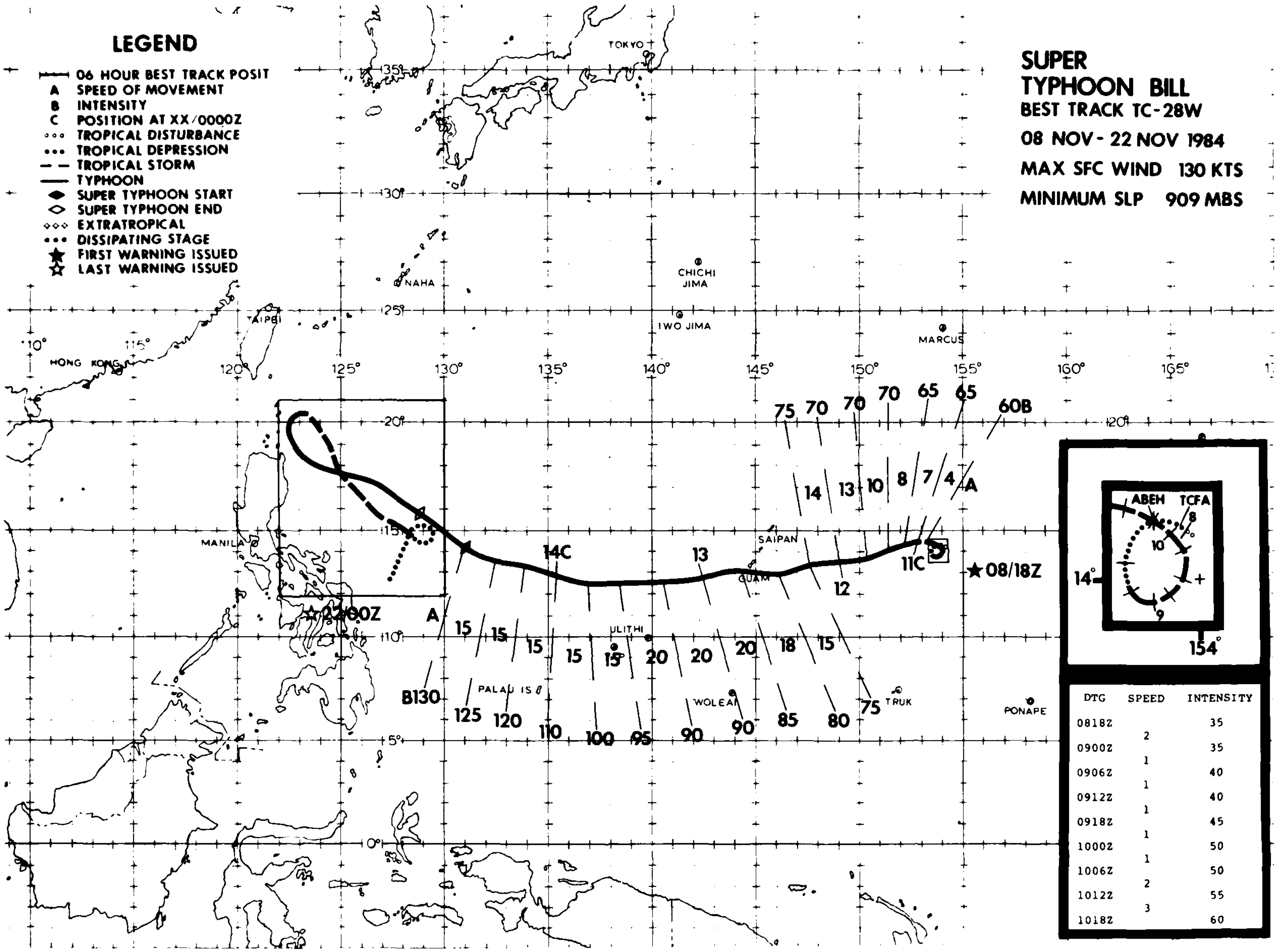
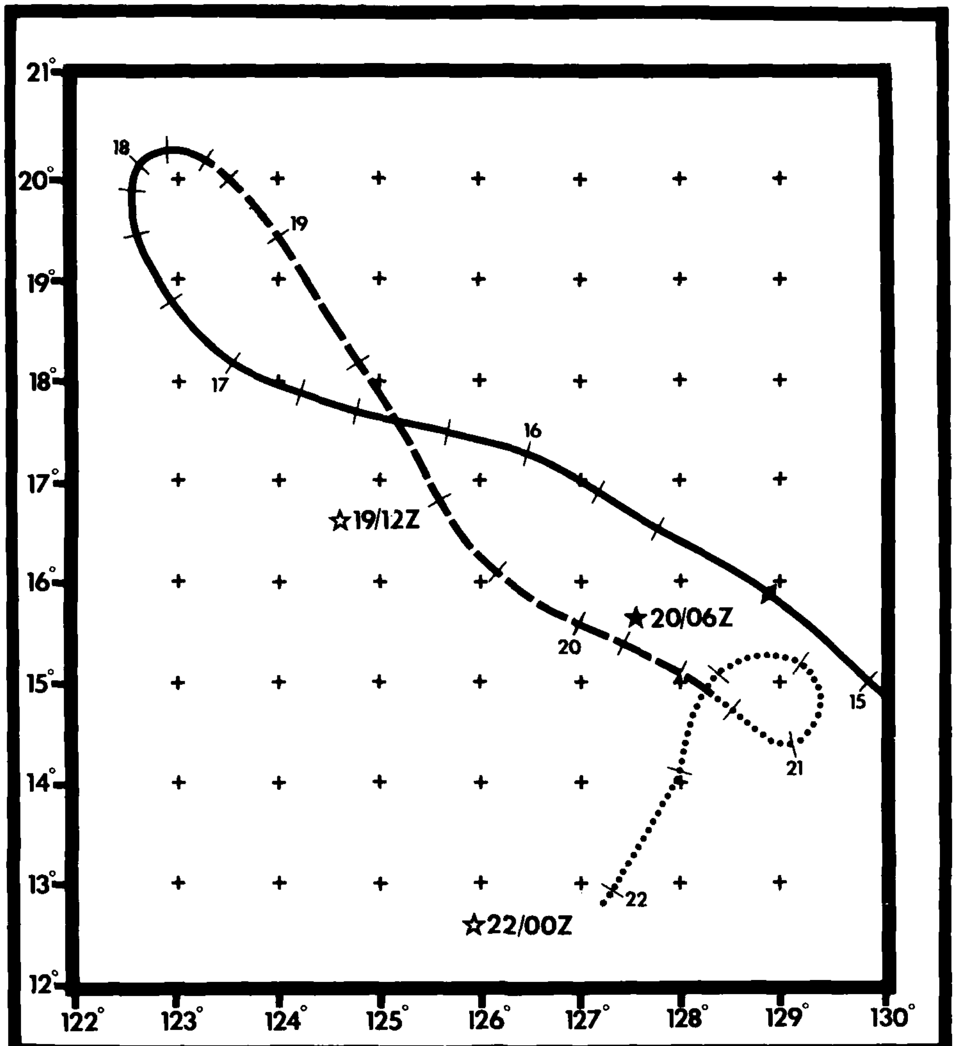


Figure 3-27-2. Typhoon Agnes at 100 kt (51 m/s) intensity just prior to making landfall over central Vietnam (070801Z November NOAA visual imagery).



DTG	SPEED	INTENSITY
0818Z		35
0900Z	2	35
0906Z	1	40
0912Z	1	40
0918Z	1	45
1000Z	1	50
1006Z	1	50
1012Z	2	55
1018Z	3	60



DTG	SPEED	INTENSITY	DTG	SPEED	INTENSITY
1418Z		130	1812Z		65
	14			3	
1500Z		130	1818Z		60
	13			7	
1506Z		130	1900Z		55
	12			14	
1512Z		125	1906Z		50
	7			16	
1518Z		125	1912Z		50
	8			8	
1600Z		120	1918Z		45
	8			8	
1606Z		120	2000Z		45
	8			5	
1612Z		115	2006Z		40
	7			5	
1618Z		110	2012Z		40
	6			7	
1700Z		100	2018Z		30
	8			6	
1706Z		90	2100Z		30
	7			7	
1712Z		90	2106Z		30
	5			7	
1718Z		80	2112Z		25
	4			11	
1800Z		80	2118Z		25
	3			13	
1806Z		70	2200Z		25
	3				

SUPER TYPHOON BILL (28W)

The second and last super typhoon of the 1984 season led a rather unusual life. After forming east of Guam, it made a small cyclonic loop before heading to the west-southwest. Two days later, Bill passed just to the south of Guam by which time it had accelerated to almost 20 kt (37 km/hr). After causing some damage on the island of Guam, Bill entered the Philippine Sea and turned to the west-northwest. Although it was expected to recurve to the northeast and follow a track similar to that of Super Typhoon Vanessa, due to a complex steering environment including interaction with Typhoon Clara, Bill instead turned to the southeast before eventually dissipating east of the Philippines. Although this track is unusual, it is not uncommon for late season storms to move erratically for at least a portion of their life.

Super Typhoon Bill originated as an area of convection on 7 November near 14N 154E. The convection was at the trailing end of an eastward moving cold front and this may have supplied some low-level vorticity which contributed to the rapid development of the disturbance. The rapid development of the convection resulted in a TCFA at 080200Z. At the time of the TCFA, analysis of satellite imagery already indicated that 25 kt (13 m/s) surface winds were present.

The first of a total of 35 aircraft reconnaissance flights flown against Bill found the disturbance's circulation center at 080721Z but observed surface winds of only 20 kt (10 m/s). The system showed continued development during the next 12 hours, and as a result the first warning was issued at 081800Z.

From the 8th until the 10th, Bill slowly tracked in a 25 nm (46 km) wide cyclonic loop and continued to strengthen. At 0000Z on 10 November, reconnaissance aircraft reported that Bill had intensified to a 50 kt (26 m/s) tropical storm with an MSLP of 990 mb.

Bill attained typhoon strength on the 10th. The weak steering flow which had been present was replaced by easterly flow as the subtropical ridge strengthened to the north of the storm. At approximately 100600Z Bill completed its cyclonic loop and started to move to the west and then southwest on a course that would eventually bring the typhoon to the southern tip of Guam. On the 11th and 12th, Bill accelerated and gradually intensified (Figure 3-28-1). With Bill forecast to pass within 60 nm (111 km) of Guam, tropical cyclone Condition of Readiness III was set on the afternoon of 11 November. On the morning of the 12th, with Bill now

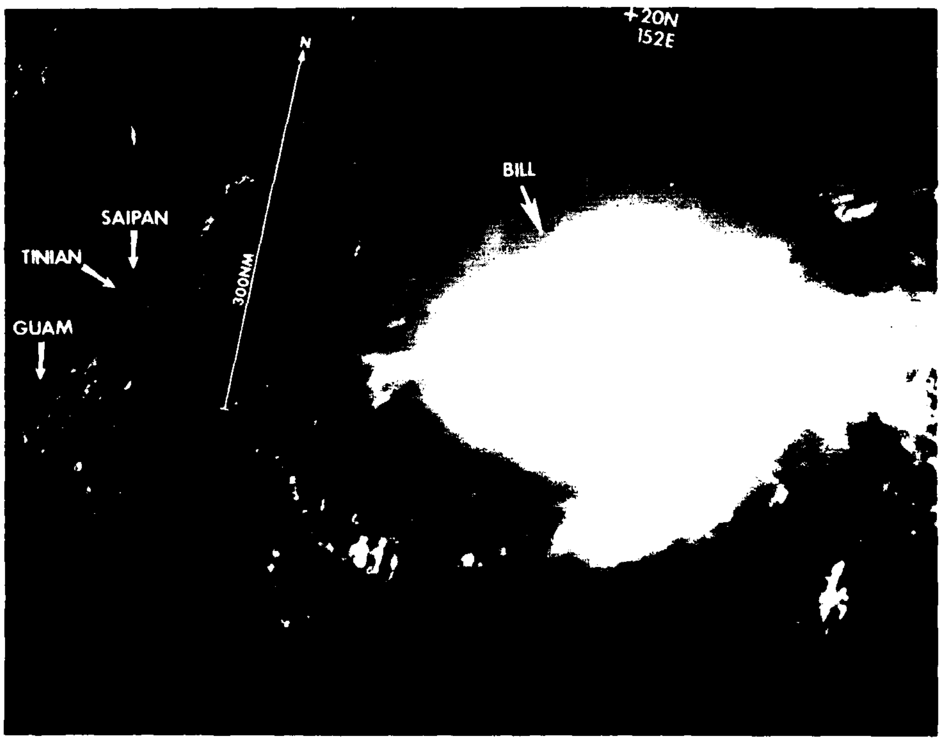


Figure 3-28-1. Bill consolidating east of Guam (110003Z November DMSP visual imagery).

forecast to pass less than 30 nm (56 km) south of the island, Condition of Readiness II was set at 112330Z.

Although Guam was forecast to be in the "dangerous" semicircle of the typhoon, the strength of the flow around the ridge did have a positive effect on Guam. Bill accelerated from 15 to 20 kt (28 to 37 km/hr) as it passed Guam thereby considerably shortening the time the typhoon affected the island. This rapid forward speed may also have been a factor in the slow intensification of the system. Only a 15 kt (8 m/s) increase in intensity occurred during the 24 hour period between 111800Z and 121800Z as Bill approached Guam.

Condition of Readiness I was set on the evening of the 12th, as Bill neared Guam. Typhoon Bill passed the southern tip of the island at 121630Z at a distance of 12 nm (22 km). Figure 3-28-2 contains a plot of the data obtained by reconnaissance air-

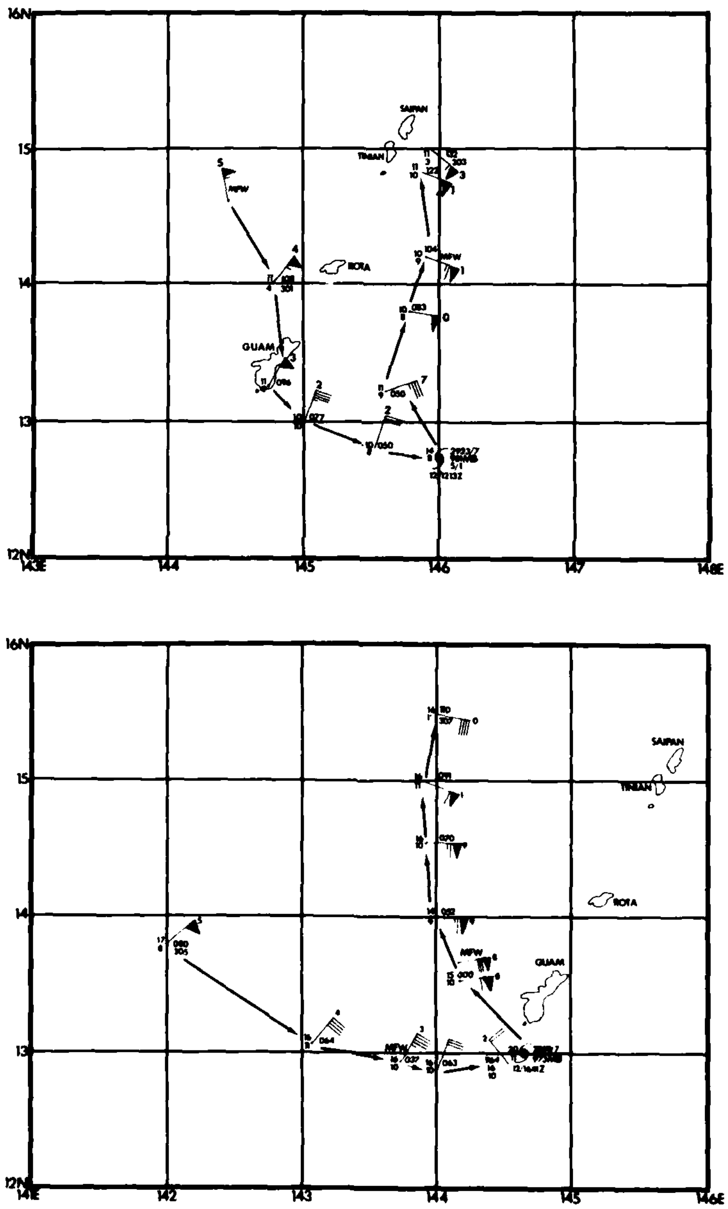


Figure 3-28-2. Plot of data obtained at the 700 mb level by aircraft reconnaissance on the two missions flown as Bill passed south of Guam.

craft during the two missions flown when Bill was at its closest point of approach to Guam. On the island itself, a maximum wind of 63 kt (32 m/s) was recorded at the National Weather Service Station (WMO 91217) at 121658Z, with a gust of 84 kt (43 m/s) recorded at Reserve Craft Beach in Apra Harbor. Typhoon Bill caused some damage on Guam, particularly to agricultural commodities. Banana trees that had been slightly damaged during the passage of Super Typhoon Vanessa were completely destroyed by Bill. Total crop damage was estimated at $7,707,911. Some minor flooding also occurred but no personnel injuries were reported. Electrical power was out in certain sections of the island for several days.

Bill entered the Philippine Sea late on the 12th moving west at 20 kt (37 km/hr) and intensifying. In the 24 hour period between 131200Z and 141200Z, the MSLP dropped 54 mb to 912 mb and the wind speed increased from 95 kt (49 m/s) to 125 kt (64 m/s) (Figure 3-28-3). The pressure continued to drop for another 12 hours, with aircraft reconnaissance at 142234Z reporting an MSLP of 909 mb. This was the lowest pressure reported in Bill. Bill attained super typhoon strength at approximately 141800Z which it then maintained for 12 hours.

Bill turned to the west-northwest early on the 14th and by 141800Z had turned to the northwest. It now appeared that Bill was starting to move around the western end of the subtropical ridge. What was initially expected to be a simple recurvature scenario would soon become a complex interaction between Bill, the approaching Typhoon Clara (now developing near Truk (WMO 91334)), the mid-latitude westerlies, and the northeast monsoon. These factors would eventually cause Bill to weaken, double back on its present track and eventually dissipate.

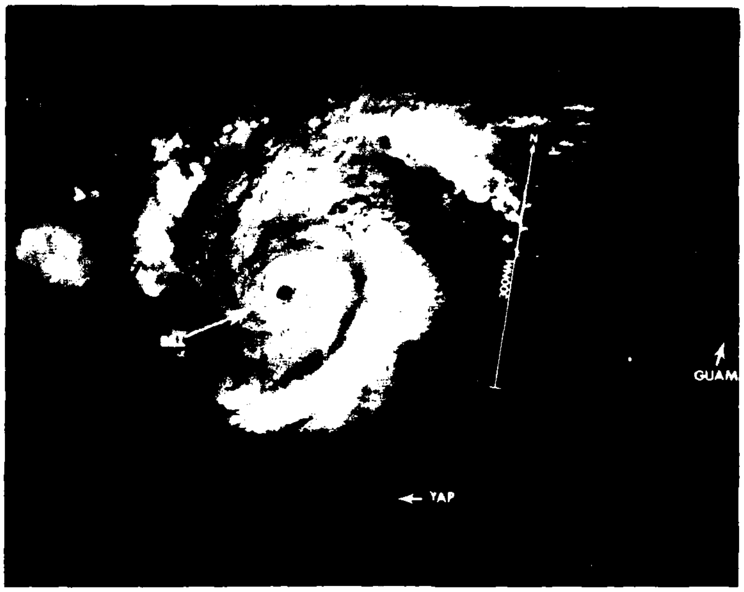


Figure 3-28-3. Typhoon Bill as it appeared on satellite imagery while undergoing rapid intensification (140044Z November DMSP visual imagery)

Bill slowed down as it moved to the northwest and by 151800Z was moving at 7 kt (13 km/hr) down from the 15 kt (28 km/hr) movement of twenty-four hours earlier. This was due to the passage of a mid-latitude trough to the north which weakened the subtropical ridge. Bill now began to weaken as it encountered strong upper-level westerlies which disrupted its outflow and sheared the convection to the northeast (Figure 3-28-4). This marked the start of a weakening trend which would continue until dissipation.

At 1200Z on the 15th, the subtropical ridge reintensified temporarily forcing Bill back on a west-northwest course which it maintained until late on the 16th. On the 17th, Bill started to track to the northwest as the ridge weakened once again. It now appeared that recurvature was finally going to occur. At 180000Z Bill turned again, this time to the northeast but unfortunately this was not to be the start of the long awaited recurvature.

At this time, three factors were involved in the steering of Bill: Typhoon Clara had become the dominant circulation in the Philippine Sea (Figure 3-28-5), the flow around the subtropical ridge was waning, and the northeast monsoon was gaining strength. The subtropical ridge was the first loser in this tug-of-war as Clara's large low-level circulation started to draw a weakening Bill to the southeast. Figure 3-28-6 shows the rapidly weakening Bill with little convection remaining as it moved towards Clara.

Bill continued to track to the southeast and weaken under the combined influence of Typhoon Clara and the westerlies. Aircraft reconnaissance at 191130Z confirmed this weakening trend. The MSLP had risen to 997 mb and the maximum observed 700 mb flight

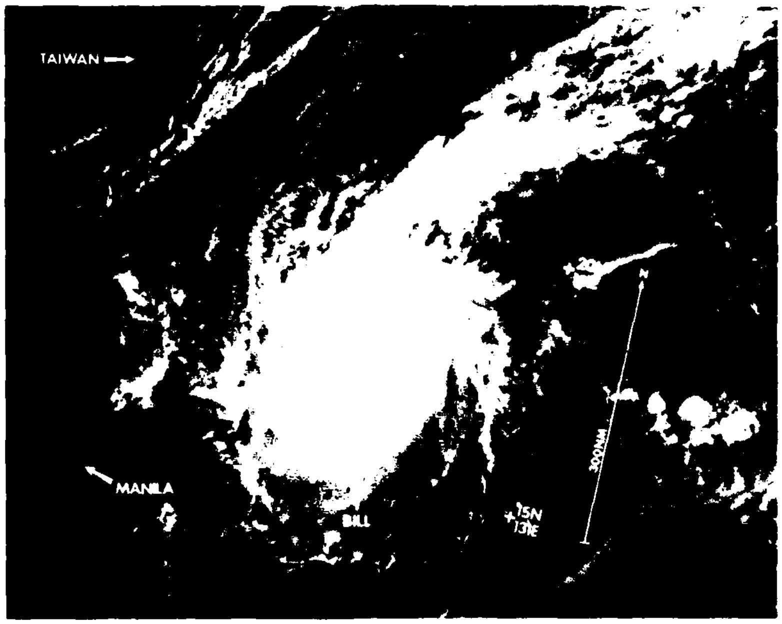


Figure 3-28-4. Bill east of Luzon as it encountered the upper-level westerlies and began to weaken. Note the cloud covered eye and the cirrus streaming to the northeast (160145Z November DMSP visual imagery).

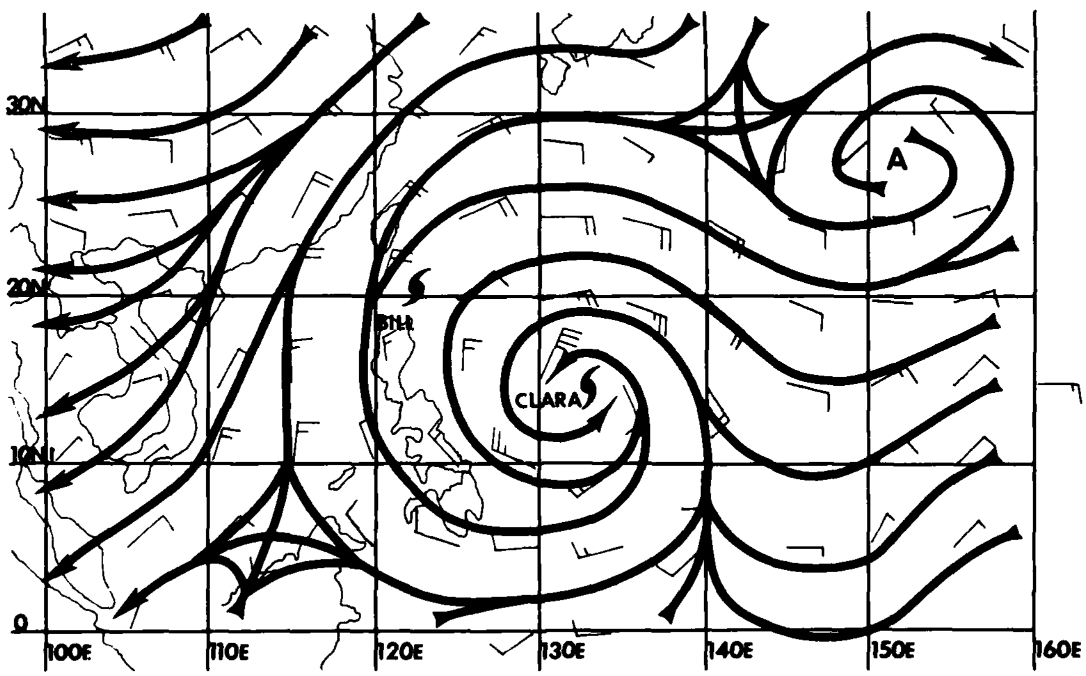


Figure 3-28-5. The 181200Z 925 mb NVA analysis showing the dominance of Typhoon Clara in the Philippine Sea. Bill which supported 65 kt (33 m/s) winds at this time was a small circulation compared to Clara and the northeast monsoon.

level wind was 28 kt (14 m/s). (Since the mission was flown at night, no surface wind data were available.) Based on the aircraft reconnaissance data and the lack of convection and organization on satellite imagery, Bill was downgraded to a tropical depression and finaled at 191200Z. As it turned out, this was premature. Early on the 20th, with Clara completing recurvature along 132E and accelerating to the northeast, its influence on Bill weakened and Bill began to regenerate some convection. Visible imagery indicated that a low-level circulation center was present. Aircraft reconnaissance a short time later, flying in the daylight at the 1500 ft (457 m) level at 200205Z reported that Bill was still moving to the southeast and now had an MSLP of 999 mb. The aircraft also reported, that a well-defined low-level circulation with 40 to 55 kt (20 to 28 m/s) winds was present! The strongest winds were located in the western semicircle of the storm and were being enhanced by the northeast monsoon. As a result Bill was returned to warning status as a tropical storm at 200600Z (Figure 3-28-7).

Although the aircraft wind data suggests that Bill intensified between 191200Z and 200600Z, this is not considered likely. Due to the weak mid-level winds reported on the 191130Z fix mission, JTWC had the impression that Bill was rapidly dissipating. In fact Bill still possessed a well-defined surface

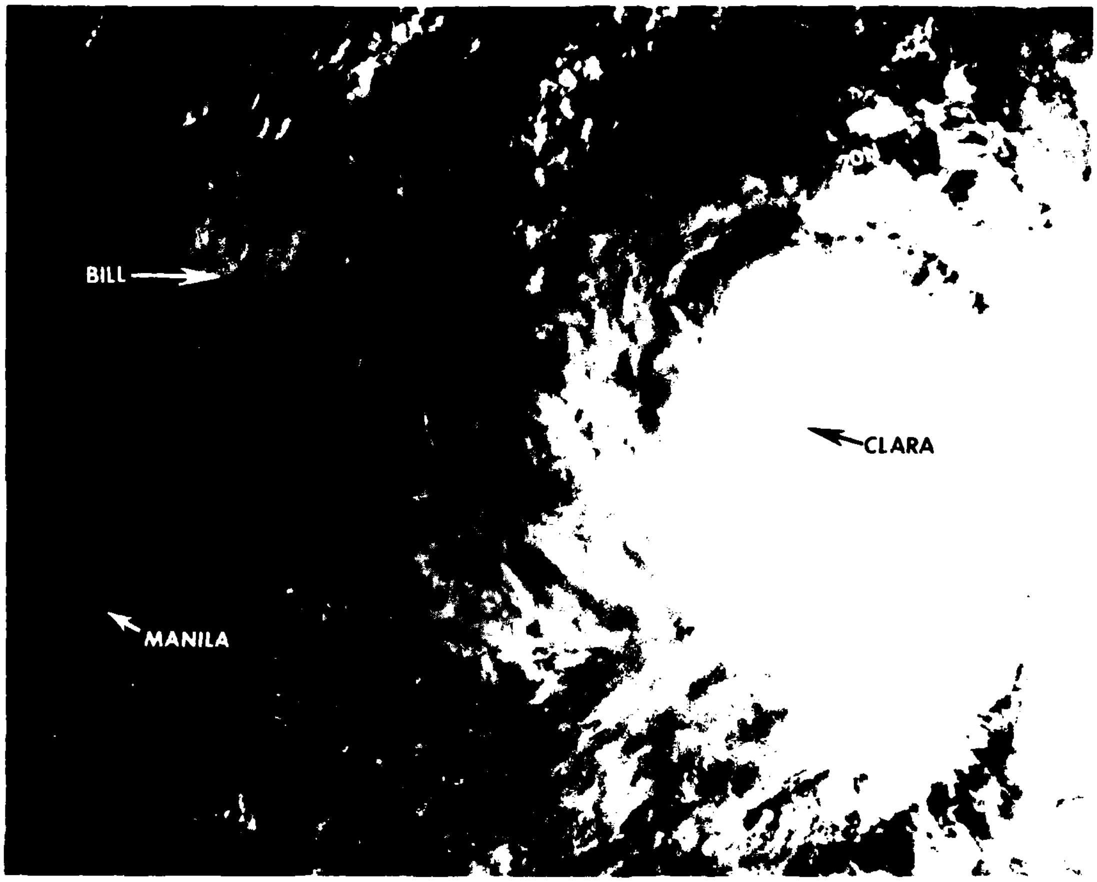
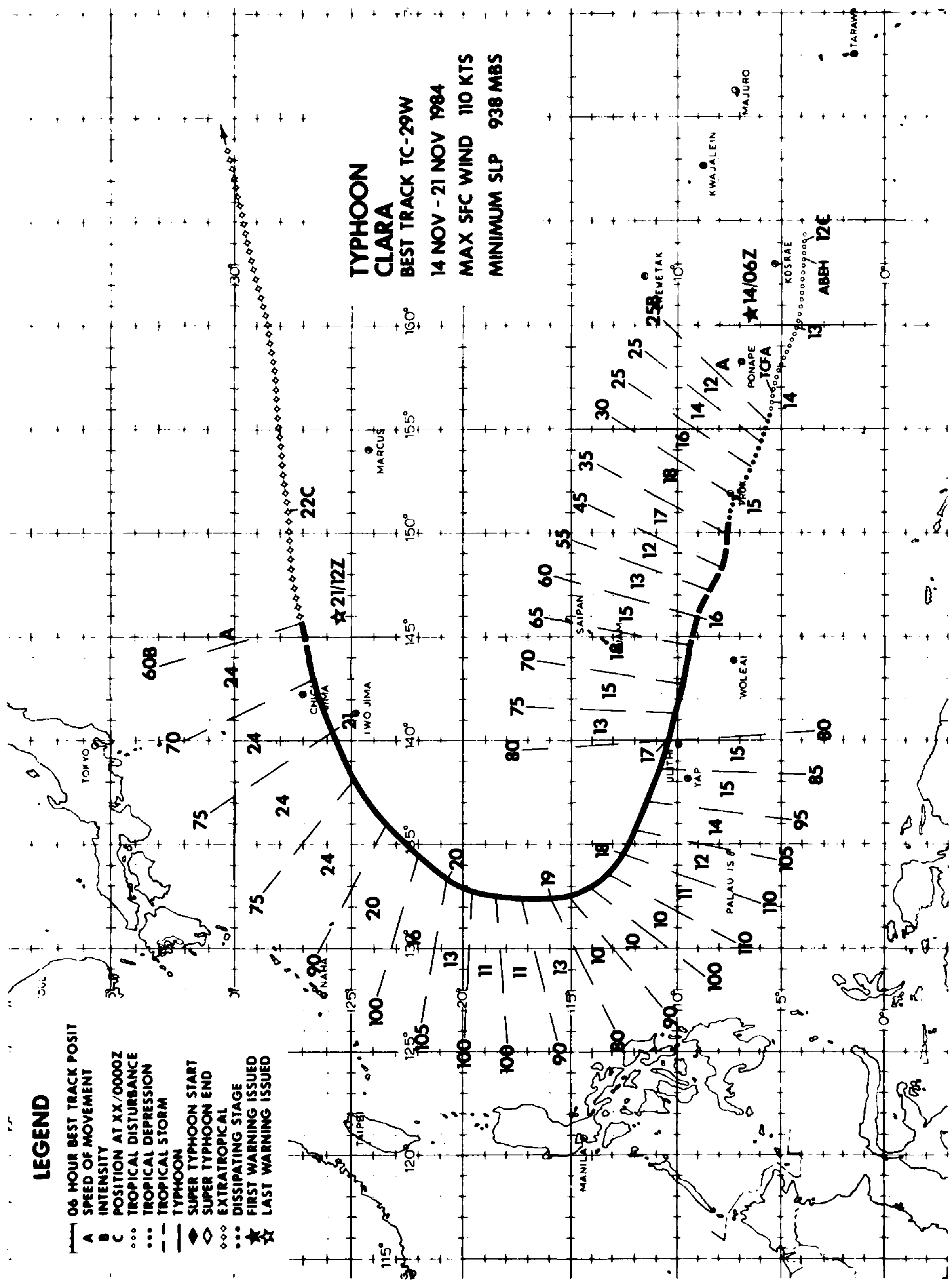


Figure 3-28-6. A weakened Bill as it heads southeast under the influence of Clara's inflow (182258Z November NOAA visual imagery).

circulation which was weakening at a much slower rate that the mid-level circulation. If the 191130Z fix mission had been able to observe surface winds it would probably have reported that 50 kt (26 m/s) surface winds were still associated with Bill.

As it turned out, the increase in convection was temporary. As Clara moved further away, its effect lessened and Bill slowed, doing a small cyclonic loop on the 21st. Bill was now under the influence of the northeast monsoon which pushed the low-level circulation to the southwest. By the 22nd the low-level circulation became embedded in the northeast monsoon, and Bill was no longer identifiable as a significant tropical cyclone. The final warning was issued at 220000Z. Although the low-level circulation dissipated in the Philippine Sea, residual convection brought locally heavy rains to the central Philippines early on the 23rd of November.

Figure 3-28-7. Typhoon Clara accelerating to the northeast and beginning extratropical transition. Bill now has more convection than 24 hours earlier, but this convective flare-up was temporary (200700Z November NOAA visual imagery).



LEGEND
06 HOUR BEST TRACK POSIT
A SPEED OF MOVEMENT
B INTENSITY
C POSITION AT XX/0000Z
TROPICAL DISTURBANCE
TROPICAL DEPRESSION
TROPICAL STORM
TYPHOON
SUPER TYPHOON START
SUPER TYPHOON END
EXTRATROPICAL
DISSIPATING STAGE
FIRST WARNING ISSUED
LAST WARNING ISSUED
TYPHOON
CLARA
BEST TRACK TC-29W
14 NOV - 21 NOV 1984
MAX SFC WIND 110 KTS
MINIMUM SLP 938 MBS
TOKYO
CHICHI JIMA
IWO JIMA
MARCUS
SAIPAN
GUAM
ULITHI
YAP
WOLEAI
PALAU IS
MANILA
TAIPEI
NAHA
ENEWETAK
KWAJALEIN
MAJURO
TARAWA
KOSRAE
PONAPE
TRUK
★14/06Z
☆21/12Z
TCFA
22C
ABEH

TYPHOON CLARA (29W)

Typhoon Clara was the last significant tropical cyclone to develop during the month of November. It developed into a textbook, late-season recurver and was noteworthy due to its effect on Super Typhoon Bill.

Clara began as a large, low-latitude disturbance in the eastern Caroline Islands. It was located by surface synoptic data before it was identified in satellite imagery. This disturbance first appeared late on 11 November as a weak circulation near 4N 164E and received first mention as a suspect area in the 120600Z Significant Tropical Weather Advisory (ABEH PGTW). By 130000Z, a very broad area of convection was associated with the circulation. The circulation's development was aided by the presence of a disturbance in the Southern Hemisphere near the Solomons which strengthened the westerly flow south of the circulation. These westerlies combined with the northeast trades to the north to supply the excess low-level vorticity needed for continued development. The upper-level pattern was also favorable with anticyclones over Super Typhoon Bill and over the Solomons providing divergence aloft over the developing system. This cross-equatorial interaction at both the surface and 200 mb level was instrumental in the development of Typhoon Clara.

The area continued to consolidate throughout the day and at 131600Z the ABEH was reissued upgrading the system's potential for development to "fair". Analysis of satellite imagery at this time yielded an intensity estimate of 25 kt (13 m/s) with a forecast to intensify. An aircraft investigation was requested for later in the day and with continued development evident, a TCFA was issued at 132030Z. AT 140454Z aircraft reconnaissance found a surface center with 15 to 25 kt (8 to 13 m/s) winds; consequently warning number one was issued at 140600Z. Figure 3-29-1 shows Clara fifteen hours later as a 30 kt (15 m/s) tropical depression.

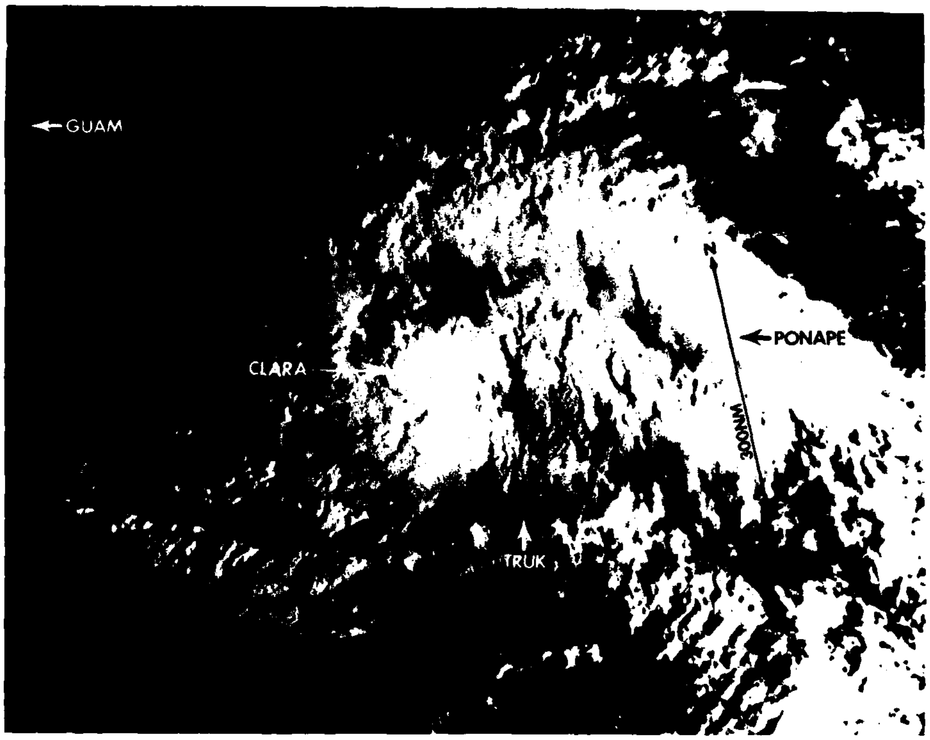


Figure 3-29-1. Clara at Tropical Depression intensity during its consolidation stage. Maximum surface winds at this time were near 30 kt (15 m/s). This system was upgraded to Tropical Storm Clara less than nine hours later (142113Z November NOAA *visual imagery).*

From this point on, Clara was a well-behaved and well forecast system. As Clara intensified it developed into a large circulation. As early as 151200Z, Clara controlled as much inflow as Bill, and by late on the 16th was clearly the dominant of the two storms. Progress along its track was typical of a well-behaved fast moving typhoon, and anticipated well in advance by JTWC. Typhoon Clara recurved just east of 132E. As Clara recurved, it passed within 500 nm (926 km) of the weakening Super Typhoon Bill. This proximity to Bill disrupted Clara's outflow and resulted in a slight weakening late on the 18th and into the 19th. However, Bill's effect on Clara was considerably less than the major course and intensity changes that Clara inflicted on Bill. Late on the 19th, as Clara recurved to the northeast and opened on Bill, it reintensified to 105 kt (54 m/s). This was just 5 kt (3m/s) less than the peak intensity of 110 kt (57 m/s) recorded prior to recurvature.

Figure 3-29-2 shows Clara after it had completed recurvature and was about to begin extratropical transition with a frontal system to the northeast. This transition was of the complex variety in which the typhoon merges with an existing front and becomes a wave on the front. This wave then propogates along the front and usually accelerates to the northeast. In this process the typhoon loses all of its convection and tropical characteristics but still retains a strong low-level wind field. In Clara's case, the transition was rapid and complete by 211200Z. The extratropical low was still discernable on satellite imagery as a frontal wave 30 hours later.

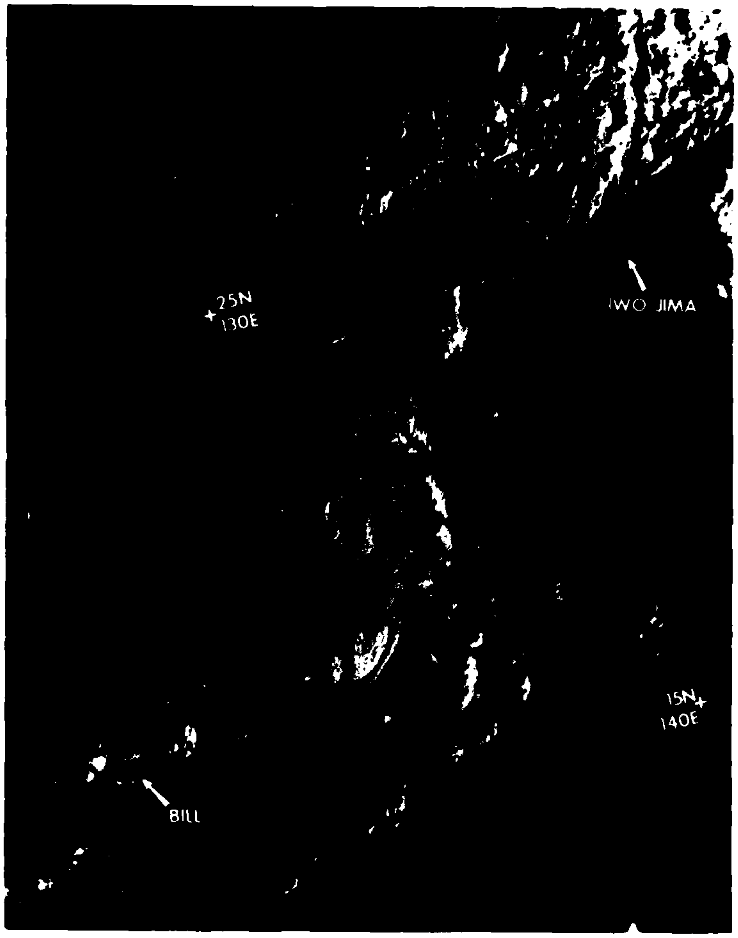
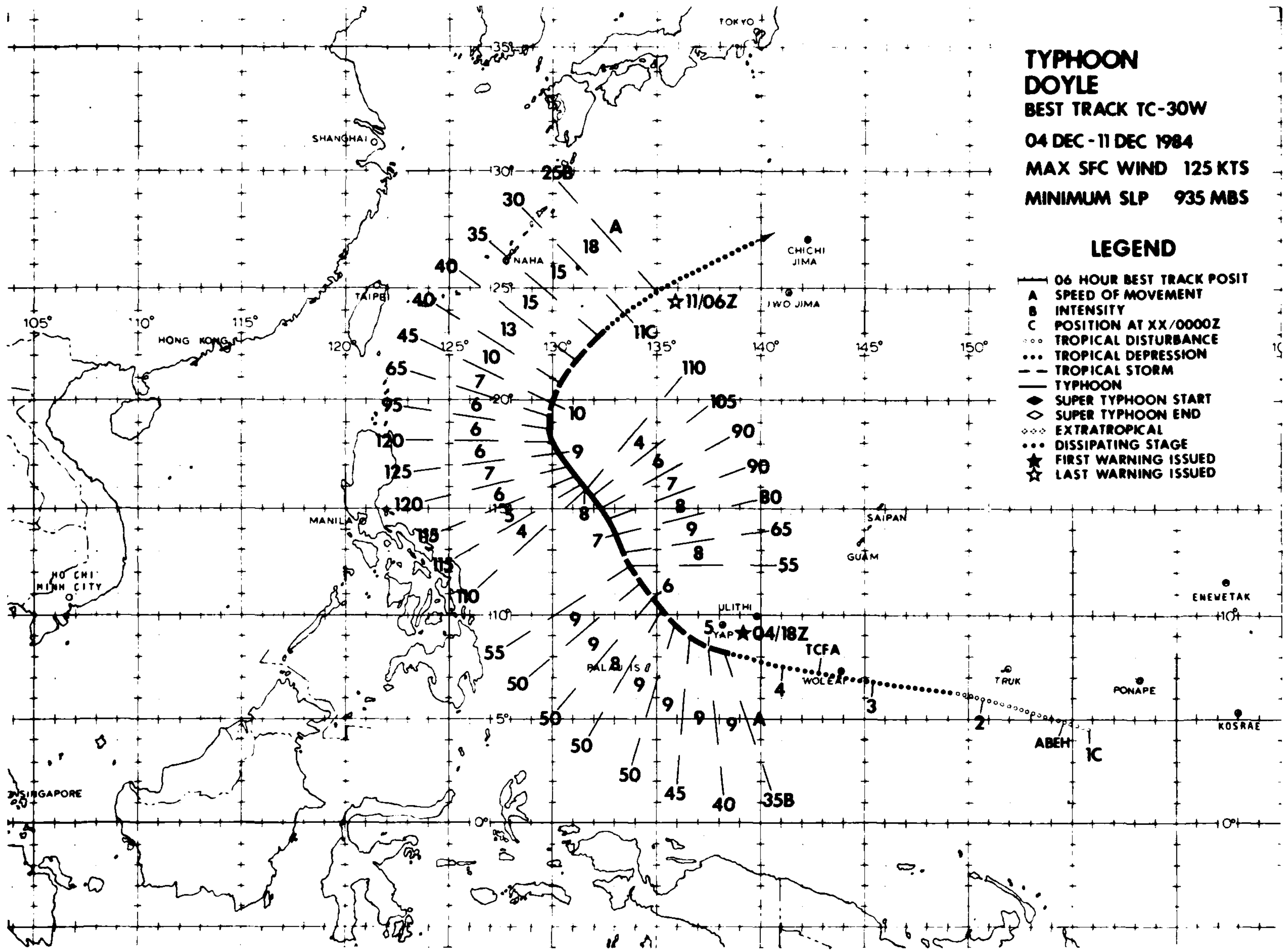


Figure 3-29-2. Typhoon Clara just after completing recurvature and about to begin extratropical transition with the frontal system to the northeast. Even this close to the weakening Super Typhoon Bill, Clara showed little indication of interaction (192234Z November NOAA visual imagery).

As Clara accelerated to the east-northeast, it passed to the north of Iwo-Jima (WMO 47981) which put the island in the dangerous semicircle of the typhoon. Sustained winds of 40 kt (21 m/s) with gusts to 63 kt (32 m/s) were reported during Clara's passage. However, no known damage was sustained on the island.

In summary, Clara was one of the classic typhoons of 1984. Forming at low-latitudes as a very broad disturbance, Clara slowly consolidated and deepened into a 110 kt (55 m/s) system. Moving rapidly across the western Pacific, Clara recurved and, in textbook fashion, transitioned into an extratropical low while accelerating to the east-northeast. During Clara's entire lifetime, Super Typhoon Bill was active in the same portion of the ocean. Even though they were at times close to each other, Bill had no noticable effect on Clara's track and only minor influence on Clara's intensity.


TYPHOON
DOYLE
BEST TRACK TC-30W
04 DEC - 11 DEC 1984
MAX SFC WIND 125 KTS
MINIMUM SLP 935 MBS
LEGEND
06 HOUR BEST TRACK POSIT
A SPEED OF MOVEMENT
B INTENSITY
C POSITION AT XX/0000Z
TROPICAL DISTURBANCE
TROPICAL DEPRESSION
TROPICAL STORM
TYPHOON
SUPER TYPHOON START
SUPER TYPHOON END
EXTRATROPICAL
DISSIPATING STAGE
FIRST WARNING ISSUED
LAST WARNING ISSUED
11/06Z
04/18Z
TCFA
TOKYO
SHANGHAI
NAHA
TAIPEI
HONG KONG
MANILA
HO CHI MINH CITY
SINGAPORE
CHICHI JIMA
IWO JIMA
SAIPAN
GUAM
ULITHI
YAP
PALAU IS
WOLEAI
TRUK
PONAPE
ENEWETAK
KOSRAE

Typhoon Doyle was the final tropical cyclone of the 1984 season and the only one to develop during the month of December. Doyle followed a typical recurvature track and remained over open water throughout its lifetime.

The tropical disturbance that was to become Doyle first appeared as an area of convective activity near 5N 156E at 0000Z on the 1st of December. It was mentioned as a new suspect area on the 010600Z Significant Tropical Weather Advisory (ABEH PGTW) and was given a "poor" potential for significant tropical cyclone development.

During the next 36 hours the disturbance moved west-northwest and gradually increased in intensity and organization. During this time satellite imagery showed the disturbance was developing good upper-level support in the form of anticyclonic outflow. With the potential for significant tropical cyclone development now considered to be "fair", the ABEH was reissued at 021800Z.

Aircraft reconnaissance early on the 3rd was unable to locate a surface circulation, but did find a trough with an MSLP of 1004 mb. The system continued to show signs of increased organization prompting the issuance of a TCFA at 031100Z. On the afternoon of the 4th, aircraft reconnaissance indicated that the MSLP had dropped to 1001 mb and that 25 kt (13 m/s) surface winds were now associated with the disturbance. Again no low-level circulation center could be found. Since continued slow development was evident on satellite imagery, the TCFA was reissued at 041100Z. At this time imagery showed several spiralling convective bands were present indicating that the formation of a significant tropical cyclone was imminent. Also present at this time was a Southern Hemisphere low-level circulation in the Coral Sea east of Cape York. This vortex contributed to the development of Doyle by increasing the westerly low-level flow to its south.

Satellite imagery at 041600Z indicated that the system now had some intense

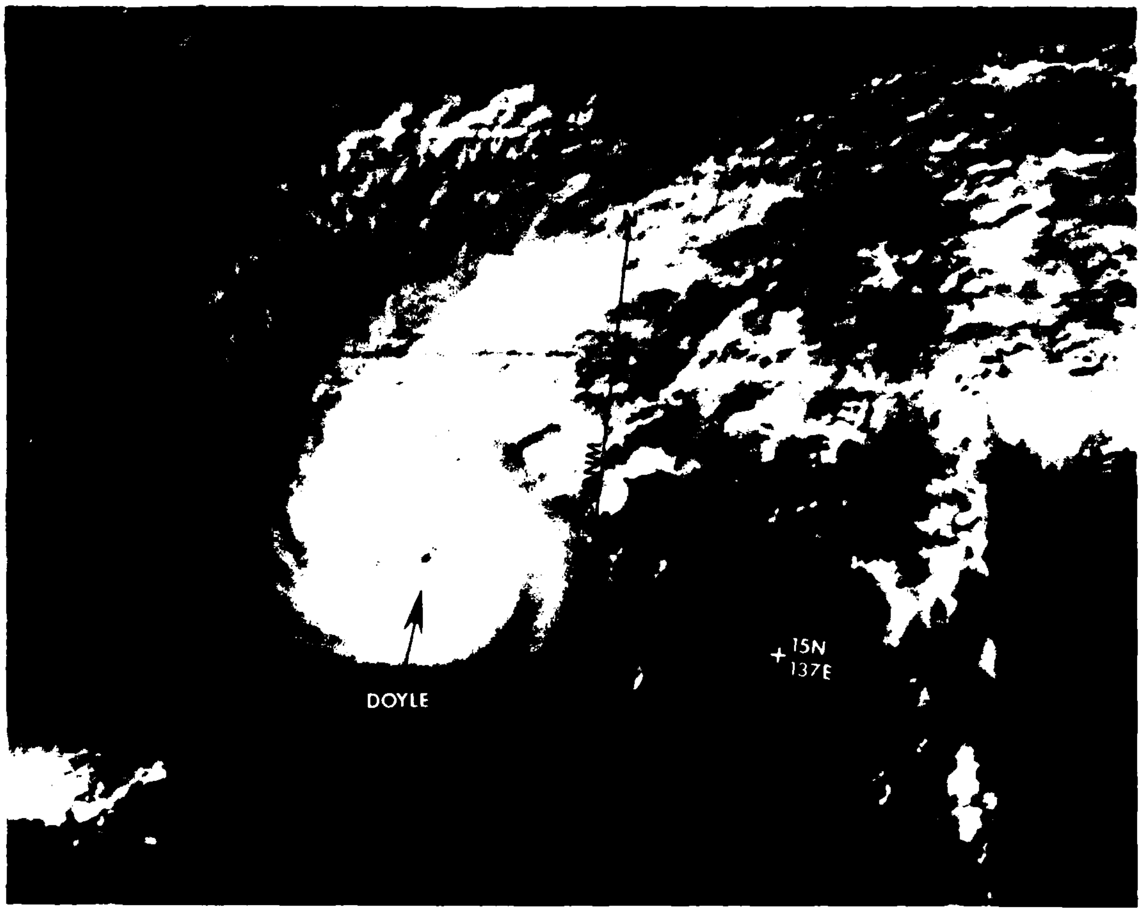


Figure 3-30-1. Typhoon Doyle one day before attaining maximum intensity (080106Z December DMSP visual imagery).

convection near the center of the developing circulation and that two intensifying convective bands were present. With Dvorak intensity analysis of this imagery indicating that 35 kt (18 m/s) surface winds were present, the initial warning on Doyle was issued at 041800Z.

An investigative flight into Doyle several hours later was finally able to locate the storm's center at 050129Z observing 40 kt (21 m/s) surface winds and measuring a central pressure of 994 mb. The surface center was very small - measuring a mere 5 nm (9 km) in diameter, with the maximum winds located 5 nm (9 km) from the center and decreasing rapidly outward. The small size of the surface center may have been a factor in the inability of previous reconnaissance flights to locate it.

During the next 48 hours, Doyle slowly intensified. Aircraft reconnaissance confirmed this slow development until the mission late on 6 December, when the central pressure was measured at 973 mb, a drop of 18 mb in just 12 hours. Maximum sustained surface winds of 90 kt (46 m/s) were observed on the north side of the storm where the easterly trades were enhancing Doyle's circulation. Doyle was upgraded to typhoon strength at 070000Z based on this information. Accompanying this intensification was a change in movement to a more northwesterly track.

The plotted values of equivalent potential temperatures versus the MSLP for the 30 hours prior to 070000Z December indicated the strong possibility of rapid deepening during the next 36 hours (Dunnavan, 1981). This indication was incorporated in the 070000Z December warning with some modification. The warnings prior to 070000Z had indicated no significant increase in intensity was likely due to the presence of the northwest monsoon flow to the north of the storm. Since that situation was still present, intensification to more than 120 kt (62 m/s) was not forecast. At this time the area north of Doyle was marked by the presence of stratocumulus clouds indicating the stability of the atmosphere in that region.

At 072047Z the MSLP had decreased to 935 mb, a fall of 43 mb in 24 hours (Figure 3-30-1). Maximum sustained winds reported by the ARWO at this time were 110 kt (57 m/s). After 072047Z, Doyle's central sea-level pressure began to rise - reaching 993 mb at 092037Z December (a rise of 58 mb in 48 hours). An unusual feature of Typhoon Doyle was the way the maximum surface winds lagged the occurrence of its MSLP. According to the best track intensities, which are based on all available data, Typhoon Doyle reached a maximum intensity of 125 kt (64 m/s) at 090000Z some 27 hours after the lowest minimum sea-level pressure was recorded!

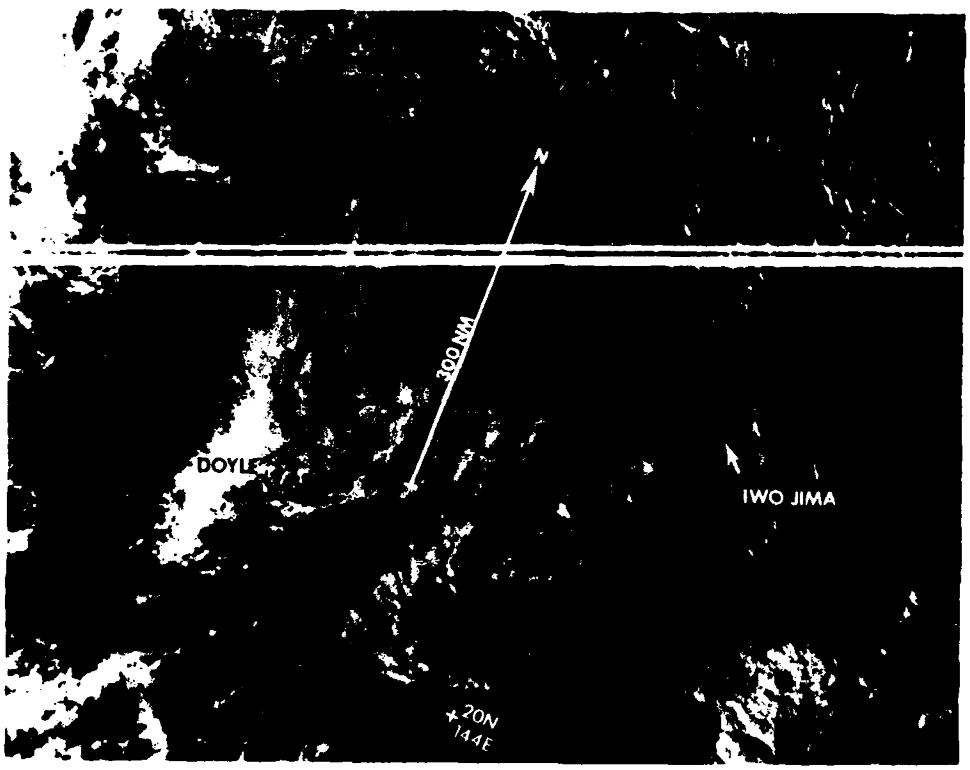


Figure 3-30-2. The exposed low-level circulation of Doyle at the time of the final warning (110601Z December NOAA visual imagery).

Between 091200Z and 100000Z, Doyle turned to the north and rapidly weakened from 95 kt (49 m/s) to 45 kt (23 m/s). Satellite imagery during this time showed a dramatic decrease in the intensity and extent of Doyle's convection. After 100000Z Doyle weakened more gradually while accelerating to the northeast. The final warning was issued at 110600Z as the nearly convection-free low-level circulation center dissipated as a significant tropical cyclone (Figure 3-30-2).

There were no reports of damages from Typhoon Doyle as it remained over open water throughout its lifetime.

2. NORTH INDIAN OCEAN TROPICAL CYCLONES

Tropical cyclone activity in the North Indian Ocean was nearly normal during 1984. Four storms originated in this area as compared to the annual average of 4.4.

Tables 3-6 through 3-8 provide a summary of North Indian Ocean tropical cyclone activity for 1984 as compared to earlier years.

TABLE 3-6.

1984 SIGNIFICANT TROPICAL CYCLONES

TROPICAL CYLONE	PERIOD OF WARNING	CALENDAR DAYS OF WARNING	NUMBER OF WARNINGS ISSUED	MAXIMUM SURFACE WIND (KT)	ESTIMATED MSLP (MB)	BEST TRACK DISTANCE TRAVELED (NM)
1. TC 01A	26 MAY - 28 MAY	3	9	45	990	819
2. TC 02B	12 OCT - 14 OCT	3	8	45	980	380
3. TC 03B	11 NOV - 15 NOV	5	16	85	975	719
4. TC 04B	28 NOV - 08 DEC	11	34	75	973	2662
	1984 TOTALS:	22	67			

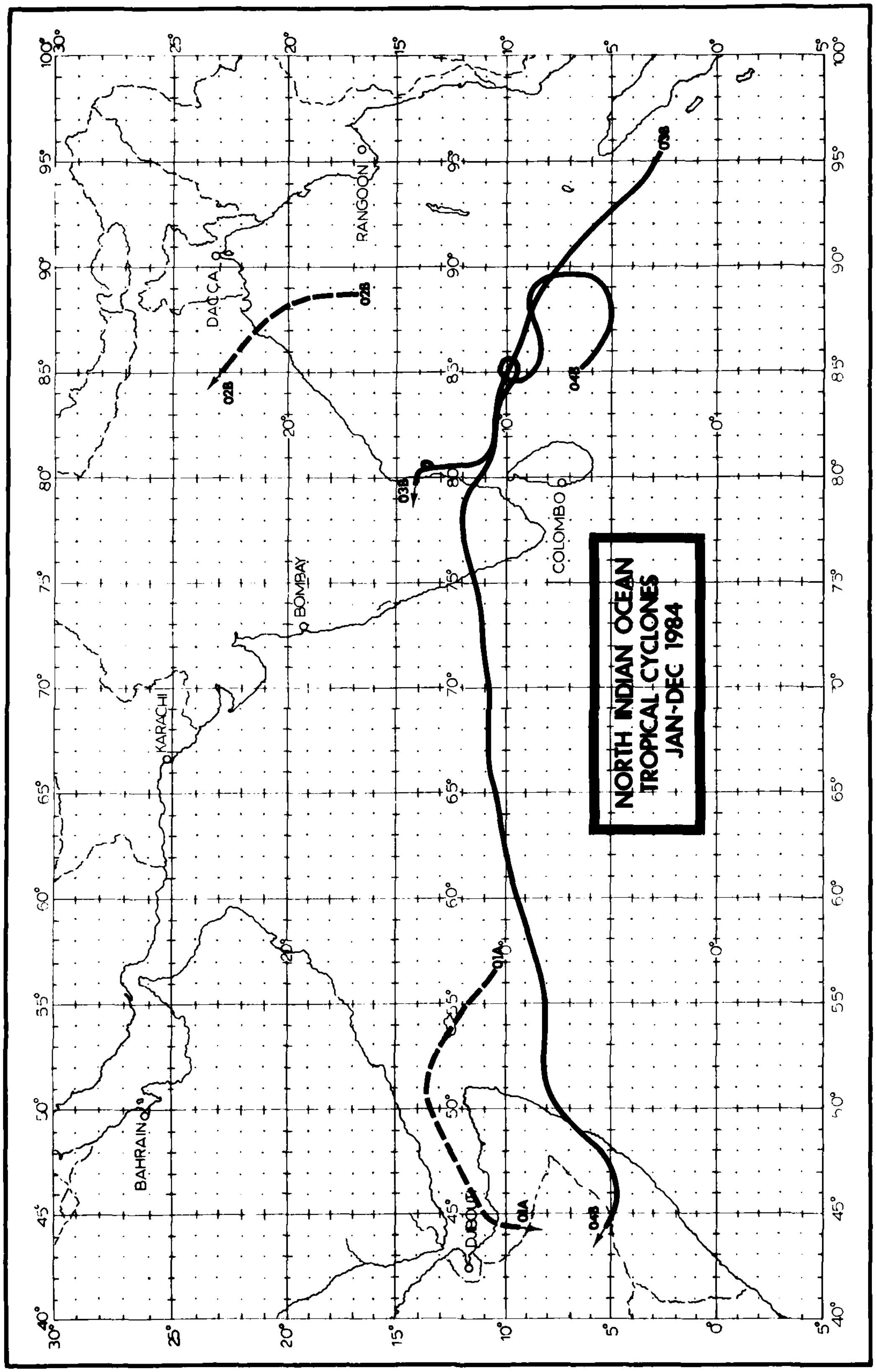
TABLE 3-7.

1984 SIGNIFICANT TROPICAL CYCLONES

NORTH INDIAN OCEAN	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
1984 TROPICAL CYCLONES	0	0	0	0	1	0	0	0	0	1	2	0	4
1975-1984 AVERAGE	.1	-	-	.1	.7	.4	-	.1	.3	1.0	1.4	.3	4.4
CASES	1	-	-	1	7	4	-	1	3	10	14	3	44

FORMATION ALERTS: 4 out of 10 Formation Alerts developed into significant tropical cyclones. Tropical Cyclone Formation Alerts were issued for all significant tropical cyclones that developed during 1984.

WARNINGS:		
	Number of warning days:	22
	Number of warning days with two tropical cyclones in region:	0
	Number of warning days with three or more tropical cyclones in region:	0



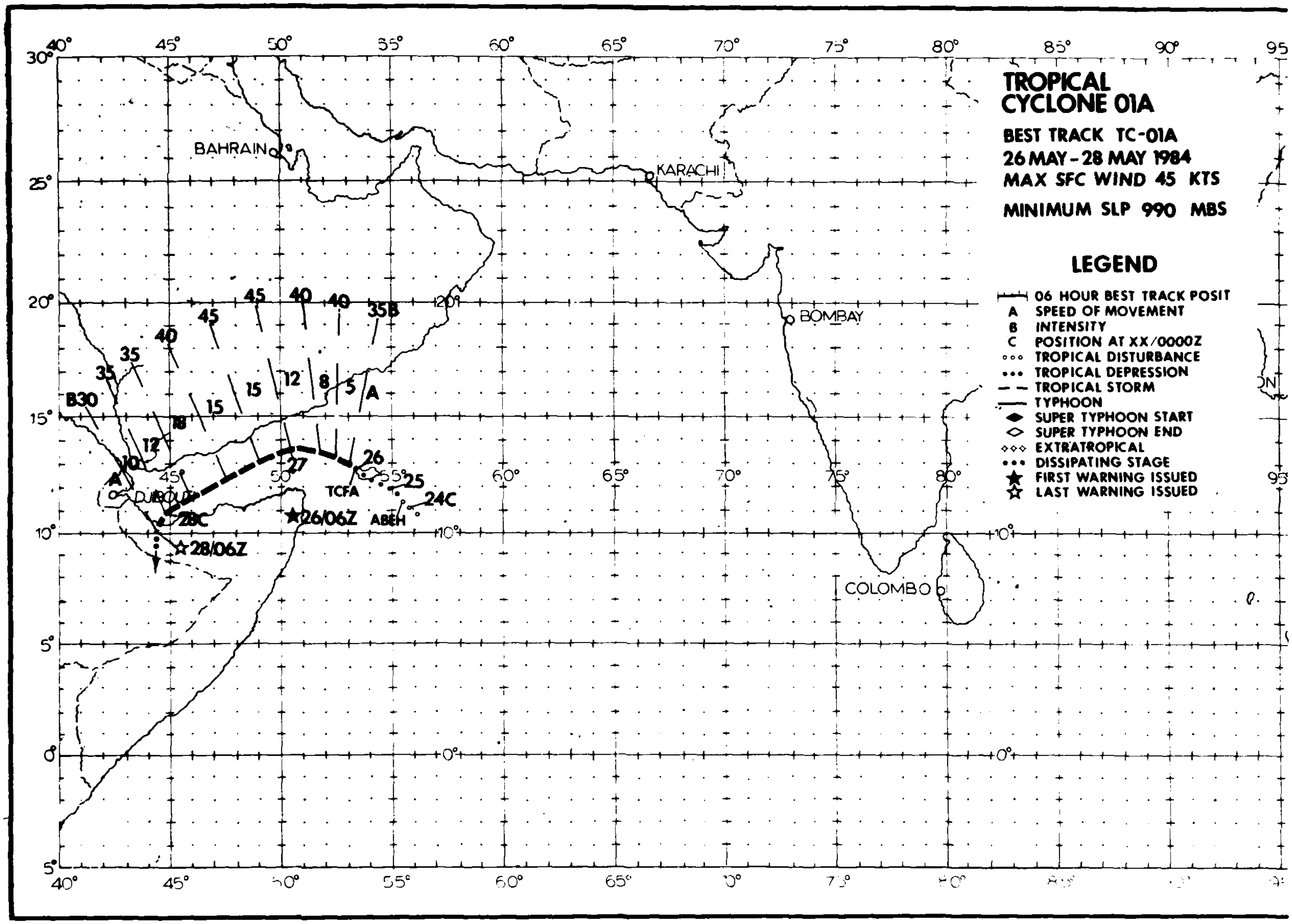
FWC/JTWC GUAM 3142/62 (NEW 2-76)

TABLE 3-8.

FREQUENCY OF TROPICAL CYCLONES BY MONTH AND YEAR

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
1971*	-	-	-	-	-	0	0	0	0	1	1	0	2
1972*	0	0	0	1	0	0	0	0	2	0	1	0	4
1973*	0	0	0	0	0	0	0	0	0	1	2	1	4
1974*	0	0	0	0	0	0	0	0	0	0	1	0	1
1975	1	0	0	0	2	0	0	0	0	1	2	0	6
1976	0	0	0	1	0	1	0	0	1	1	0	1	5
1977	0	0	0	0	1	1	0	0	0	1	2	0	5
1978	0	0	0	0	1	0	0	0	0	1	2	0	4
1979	0	0	0	0	1	1	0	0	2	1	2	0	7
1980	0	0	0	0	0	0	0	0	0	0	1	1	2
1981	0	0	0	0	0	0	0	0	0	1	1	1	3
1982	0	0	0	0	1	1	0	0	0	2	1	0	5
1983	0	0	0	0	0	0	0	1	0	1	1	0	3
1984	0	0	0	0	1	0	0	0	0	1	2	0	4
1975-1984 AVERAGE	.1	-	-	.1	.7	.4	-	.1	.3	1.0	1.4	.3	4.4
CASES	1	0	0	1	7	4	0	1	3	10	14	3	44

* JTWC warning responsibilty began on 4 June 1971 for the Bay of Bengal, east of 90E. As directed by USCINCPAC, JTWC issued warnings only for those tropical cyclones that developed or tracked through that portion of the Bay of Bengal. Commencing with the 1975 tropical cyclone season, JTWC's area of responsibilty was extended westward to include the western portion of the Bay of Bengal and the entire Arabian Sea.


TROPICAL CYCLONE 01A
BEST TRACK TC-01A
26 MAY - 28 MAY 1984
MAX SFC WIND 45 KTS
MINIMUM SLP 990 MBS
LEGEND
06 HOUR BEST TRACK POSIT
A SPEED OF MOVEMENT
B INTENSITY
C POSITION AT XX/0000Z
TROPICAL DISTURBANCE
TROPICAL DEPRESSION
TROPICAL STORM
TYPHOON
SUPER TYPHOON START
SUPER TYPHOON END
EXTRATROPICAL
DISSIPATING STAGE
FIRST WARNING ISSUED
LAST WARNING ISSUED
BAHRAIN
KARACHI
BOMBAY
COLOMBO
DJIBOUTI
TCFA
ABEH
26/06Z
28/06Z
24C
25
26
27
28C
B30
A

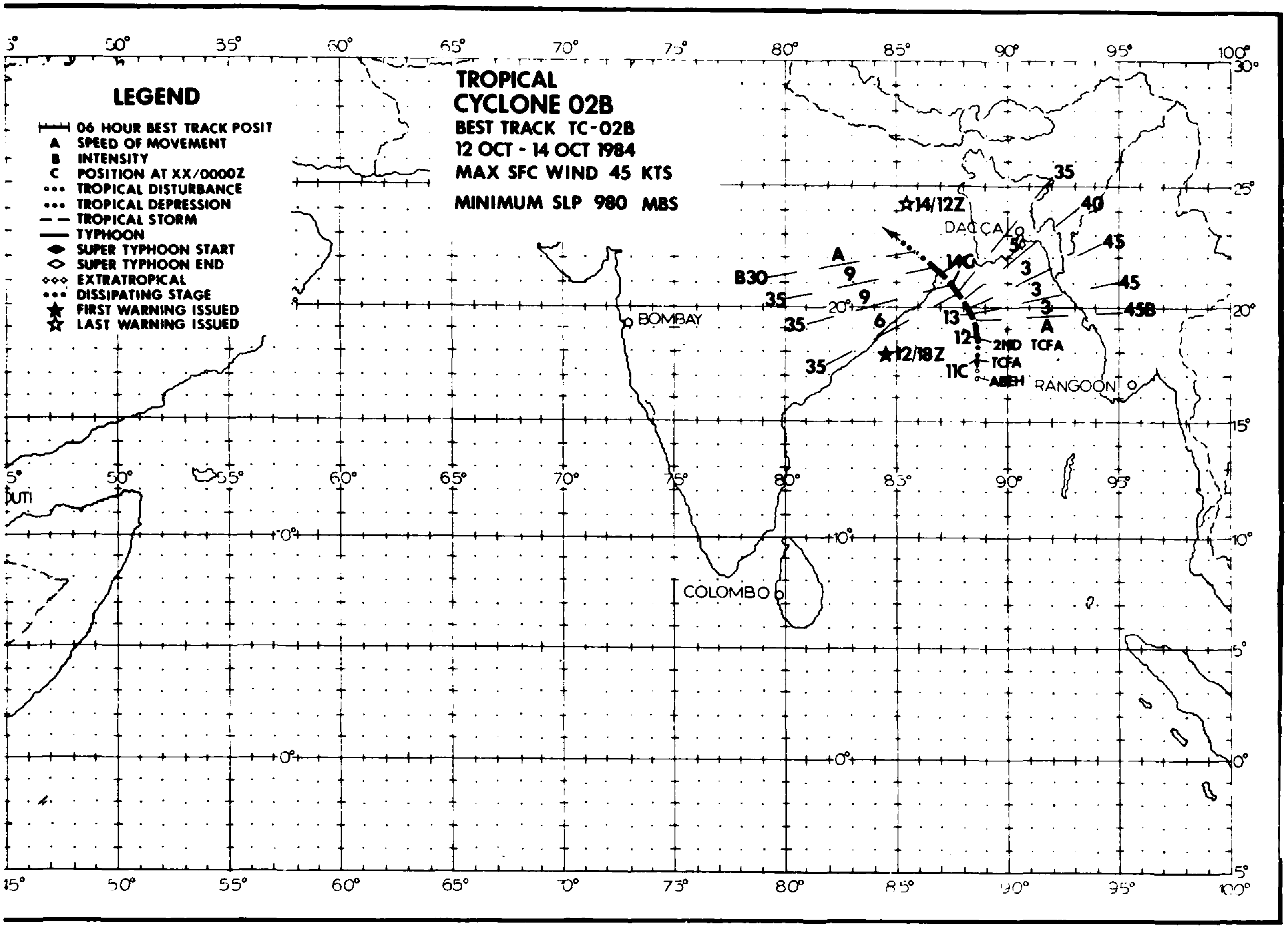
Tropical Cyclone 01A, the only tropical cyclone to develop in the North Indian Ocean during the Spring transition season, distinguished itself by its non-climatological track. After developing in the western Arabian Sea, Tropical Cyclone 01A turned to the west-southwest and transited through the Gulf of Aden rather than moving to the north or northwest along the climatologically favored track and making landfall along the east coast of the Arabian peninsula. This is the only tropical cyclone of record to transit through the Gulf of Aden.

The disturbance which eventually developed into Tropical Cyclone 01A was first detected on 23 May as an area of strong convection centered approximately 180 nm (333 km) southeast of Socotra (WMO 61599). The convection persisted and the disturbance was mentioned as a suspect area in the Significant Tropical Weather Advisory (ABEH PGTW) at 0600Z on the 24th. The disturbance moved slowly northwestward during the next 36 hours with a gradual increase in organization. At 260051Z, a TCFA was issued prompted by the persistent slow improvement in the convective organization and by indications from satellite imagery that a small but well organized low-level circulation was developing. Throughout this period, synoptic data was unable to confirm the presence of a surface circulation. At 261055Z, the first warning on Tropical Cyclone 01A, valid at 260600Z was issued. This was based on a Dvorak intensity analysis of Figure 3-31-1 which estimated that surface winds of 35 kt (18 m/s) were present.

Tropical Cyclone 01A remained a compact system throughout its life. Even at its maximum intensity of 45 kt (23 m/s) between 0000Z and 0600Z on 27 May, the radius of greater than 30 kt (15 m/s) winds was estimated to be only 60 nm (111 km). The small size of Tropical Cyclone 01A coupled with the sparsity of synoptic data in the area precluded any verification of surface intensity estimates. Intensity estimates on this system were based entirely on Dvorak satellite analysis.

Tropical Cyclone 01A moved northwestward until late on the 26th, when it turned to the west-southwest and entered the Gulf of Aden in response to a strong subtropical ridge over Saudi Arabia. Tropical Cyclone 01A transited up the Gulf of Aden until it made landfall at 0300Z on 28 May, approximately 35 nm (65 km) west of Berbera, Somalia (WMO 63160). After making landfall, Tropical Cyclone 01A moved inland over Somalia and dissipated. There were no reports of damages or injuries from this system.

Figure 3-31-1 Tropical Cyclone 01A at the entrance to the Gulf of Aden (260617Z May DMSP visual imagery).


TROPICAL
CYCLONE 02B
BEST TRACK TC-02B
12 OCT - 14 OCT 1984
MAX SFC WIND 45 KTS
MINIMUM SLP 980 MBS
LEGEND
06 HOUR BEST TRACK POSIT
A SPEED OF MOVEMENT
B INTENSITY
C POSITION AT XX/0000Z
TROPICAL DISTURBANCE
TROPICAL DEPRESSION
TROPICAL STORM
TYPHOON
SUPER TYPHOON START
SUPER TYPHOON END
EXTRATROPICAL
DISSIPATING STAGE
FIRST WARNING ISSUED
LAST WARNING ISSUED
BOMBAY
COLOMBO
DACCA
RANGOON
14/12Z
12/18Z
2ND TCFA
TCFA
ABEH
11C
12
13
14C
B30
35
40
45
45B

TROPICAL CYCLONE 02B

Tropical Cyclone 02B, the first tropical cyclone to develop in the North Indian Ocean during the Fall transition season, led a rather uneventful life. Tropical Cyclone 02B was first detected early on the 10th of October as a broad area of convection in the north-central Bay of Bengal. During the day the convection showed improved organization with cirrus plumes indicating an upper-level anticyclone existed over the disturbance. No surface synoptic data was available in the area; however, curvature of the low-level clouds indicated a developing low-level circulation was present. Dvorak intensity analysis of the 101800Z imagery estimated that surface winds of 30 kt (15 m/s) were present in the system. This prompted the issuance of the first of two TCFAs at 102300Z.

During the next two days the disturbance developed a broad circulation covering the head of the Bay of Bengal and intensified slowly. Upper-level support remained favorable for further intensification and the only inhibiting factor for development was the proximity of the disturbance to land which restricted the low-level inflow. Although Tropical Cyclone 02B formed in the monsoon trough, most of the flow from the southwest monsoon was being drawn into Tropical Storm Susan (22W) which was developing in the South China Sea. If Susan had not been present, Tropical Cyclone 02B may have developed into a more potent system.

The developing cyclone tracked slowly north until 0600Z on the 12th when a turn to the northwest began. At 121800Z the first warning was issued. The initial warning on Tropical Cyclone 02B was prompted by satellite imagery which indicated that the system had intensified significantly over the past 24 hours and was now supporting winds of 45 kt (23 m/s). Once again due to lack of synoptic data, the intensity estimate was based solely on Dvorak analysis of satellite imagery. Tropical Cyclone 02B maintained this intensity for the next 12 hours until strong upper-level easterlies began to shear the convection to the west on 13 October (Figure 3-32-1). This started a weakening trend which continued until dissipation.

As it weakened, Tropical Cyclone 02B continued moving to the northwest and increased its forward speed. At about 140300Z Tropical Cyclone 02B made landfall on the coast of India approximately 10nm (19 km) south of Balasore (WMO 42895). The system weakened rapidly over land with the final warning being issued at 141200Z. Although some heavy rains accompanied this storm as it made landfalll there have been no reports of damage.

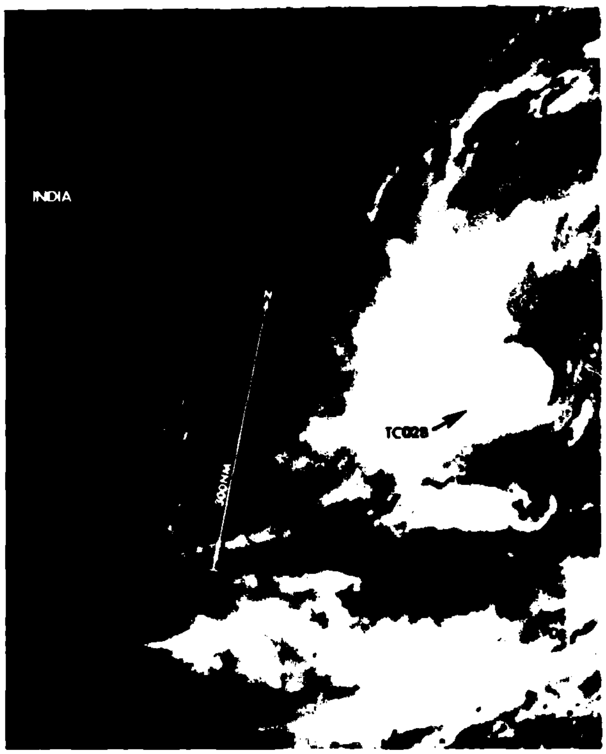
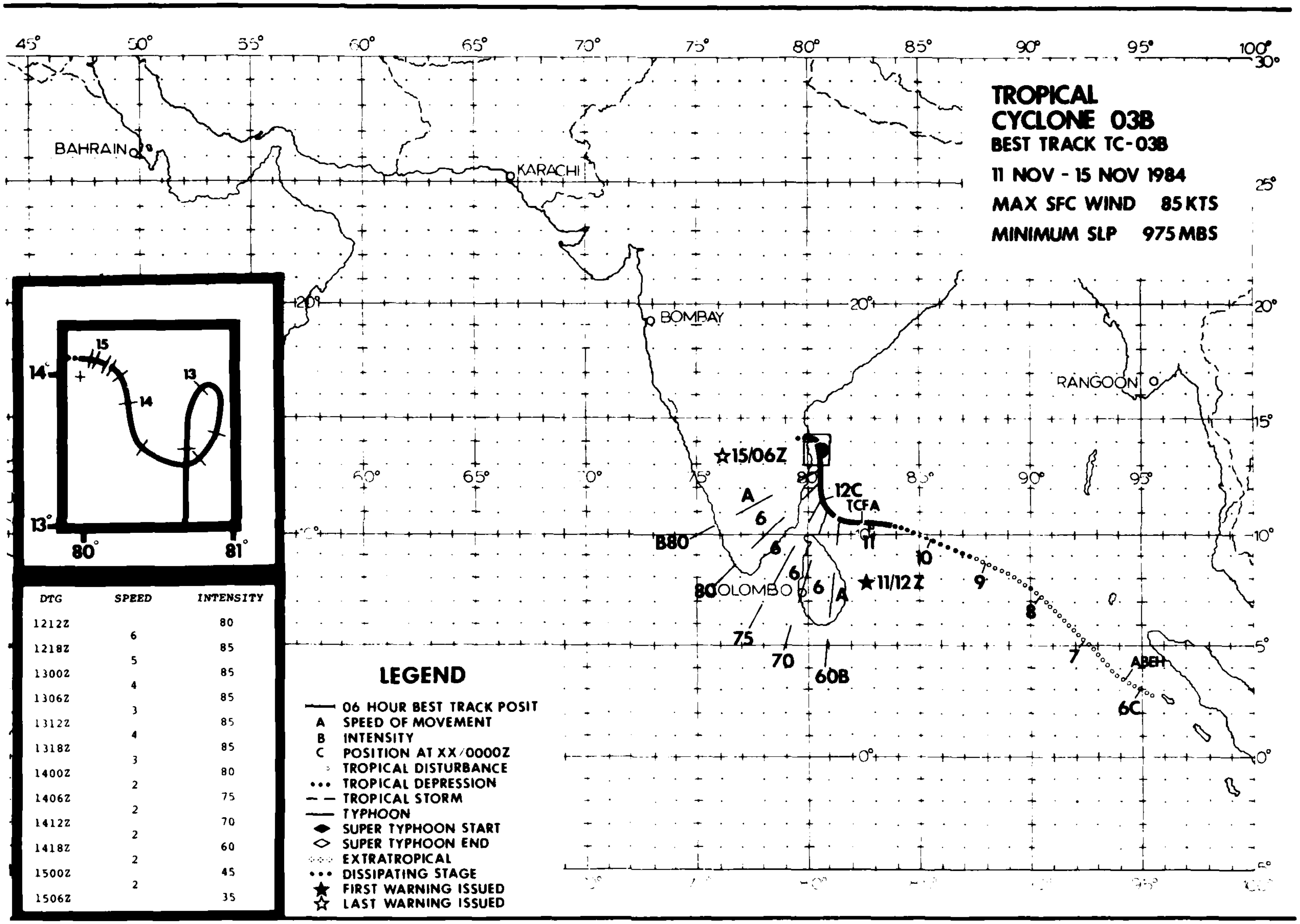


Figure 3-32-1. Tropical Cyclone 02B near maximum intensity (130446Z October DMSP visual imagery).



DTG	SPEED	INTENSITY
1212Z		80
1218Z	6	85
1300Z	5	85
1306Z	4	85
1312Z	3	85
1318Z	4	85
1400Z	3	80
1406Z	2	75
1412Z	2	70
1418Z	2	60
1500Z	2	45
1506Z	2	35

762 (NEW 2-76)

Tropical Cyclone 03B, the second cyclone to form in the North Indian Ocean during the Autumn transition season, developed into the most intense of all 1984 North Indian Ocean Storms. The storm was responsible for at least 430 deaths and has been called the worst tropical cyclone to affect the central east coast of India in 15 years.

The disturbance that would eventually develop into Tropical Cyclone 03B, was first noticed late on 5 November as a broad area of poorly organized convection west of Sumatra. Over the next few days the disturbance moved northwest. Although the system showed periodic convective flare-ups, there was no permanent significant increase in organization until 9 November. By then a well-defined low-level circulation center was visible on satellite imagery. During the 9th and into the 10th, the disturbance moved to the west-northwest with only slow development noted. At that time it was thought the disturbance might make landfall over the southeast coast of India before developing into a significant tropical cyclone. However, that was not to be the case.

Late on the 10th, analysis of satellite imagery indicated that the overall convection and organization of the disturbance was increasing. Since Dvorak intensity analysis already indicated that 30 kt (15 m/s) winds were present, a TCFA was issued at 110330Z.

Less than four hours later, JTWC received a Dvorak intensity analysis from the Air Force Global Weather Central (AFGWC) which indicated the disturbance had intensified rapidly and now supported winds of 55 kt (28 m/s)! The first warning on Tropical Cyclone 03B was issued at 111200Z.

Figure 3-33-1 is a streamline analysis of the mid-level flow that was present throughout much of the warning phase of the storm's lifetime. The dominant features are the ridging across the Bay of Bengal and the associated neutral point over the east coast of India.

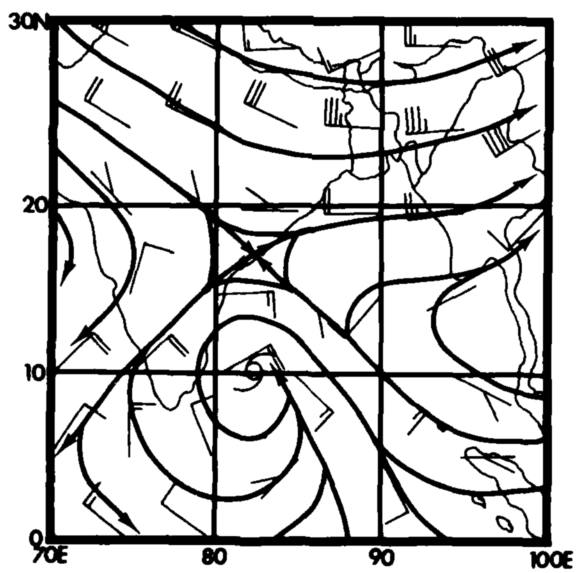


Figure 3-33-1. The mid-level flow present during much of Tropical Cyclone 03B's lifetime. Streamline analysis performed on the 111200Z November 500 mb NOGAPS wind field.

Since Tropical Cyclone 03B was firmly embedded in the southeasterly flow south of the ridge axis, the initial forecasts called for continued west-northwest movement, with dissipation over India within 36 hours. However, Tropical Cyclone 03B was to take a different course. Responding to the flow around the periphery of the ridge, the storm curved to the north and moved into the neutral point, lost all steering, and began an erratic movement. It took at least one clockwise loop (and perhaps a second) before finally drifting slowly to the northwest towards India.

As the storm moved north on the 12th, it deepened rapidly attaining a peak intensity of 85 kt (44 m/s) at 121800Z. During this development stage, the system was vertically aligned with the upper-level anticyclone. From early on the 12th until the 14th, a 6 to 15 nm (11 to 28 km) wide eye was observed on satellite imagery (Figure 3-33-2).

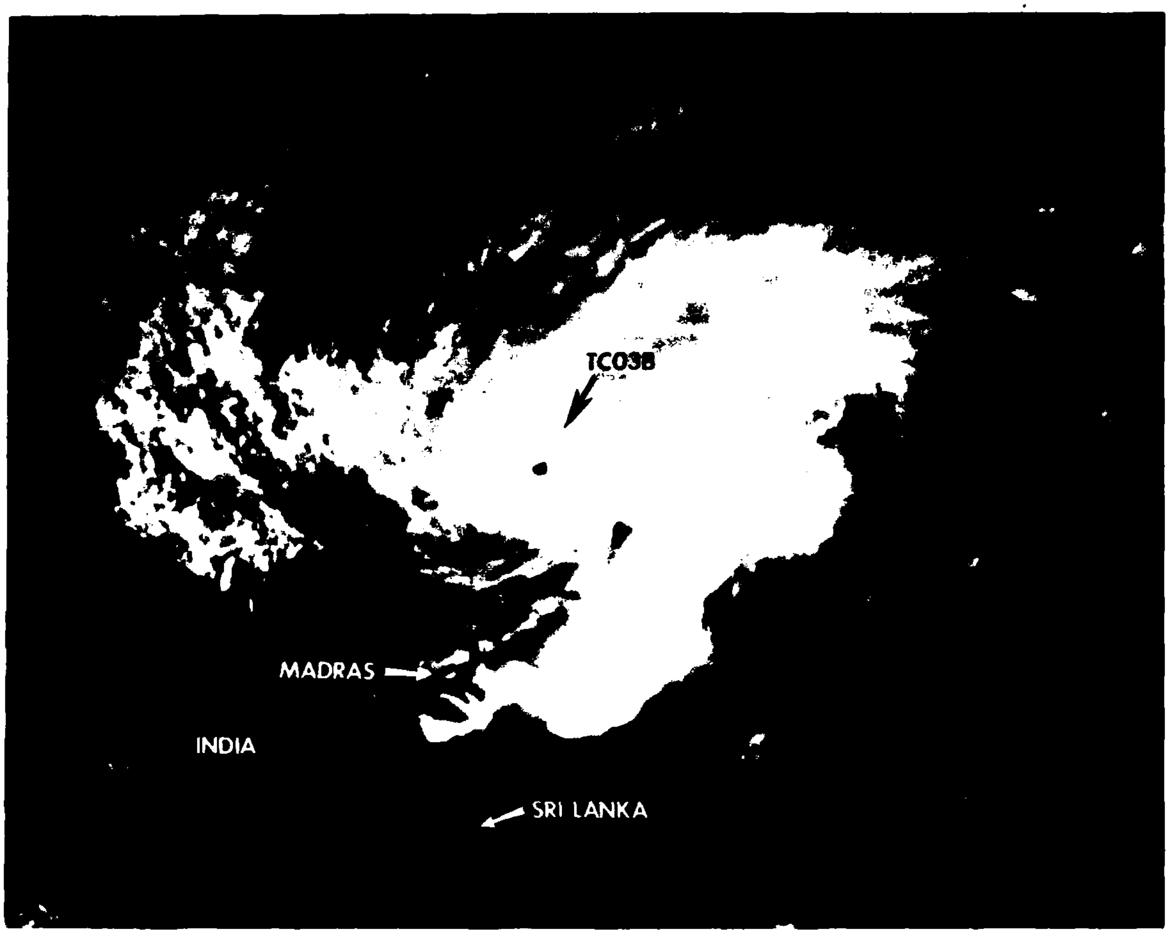
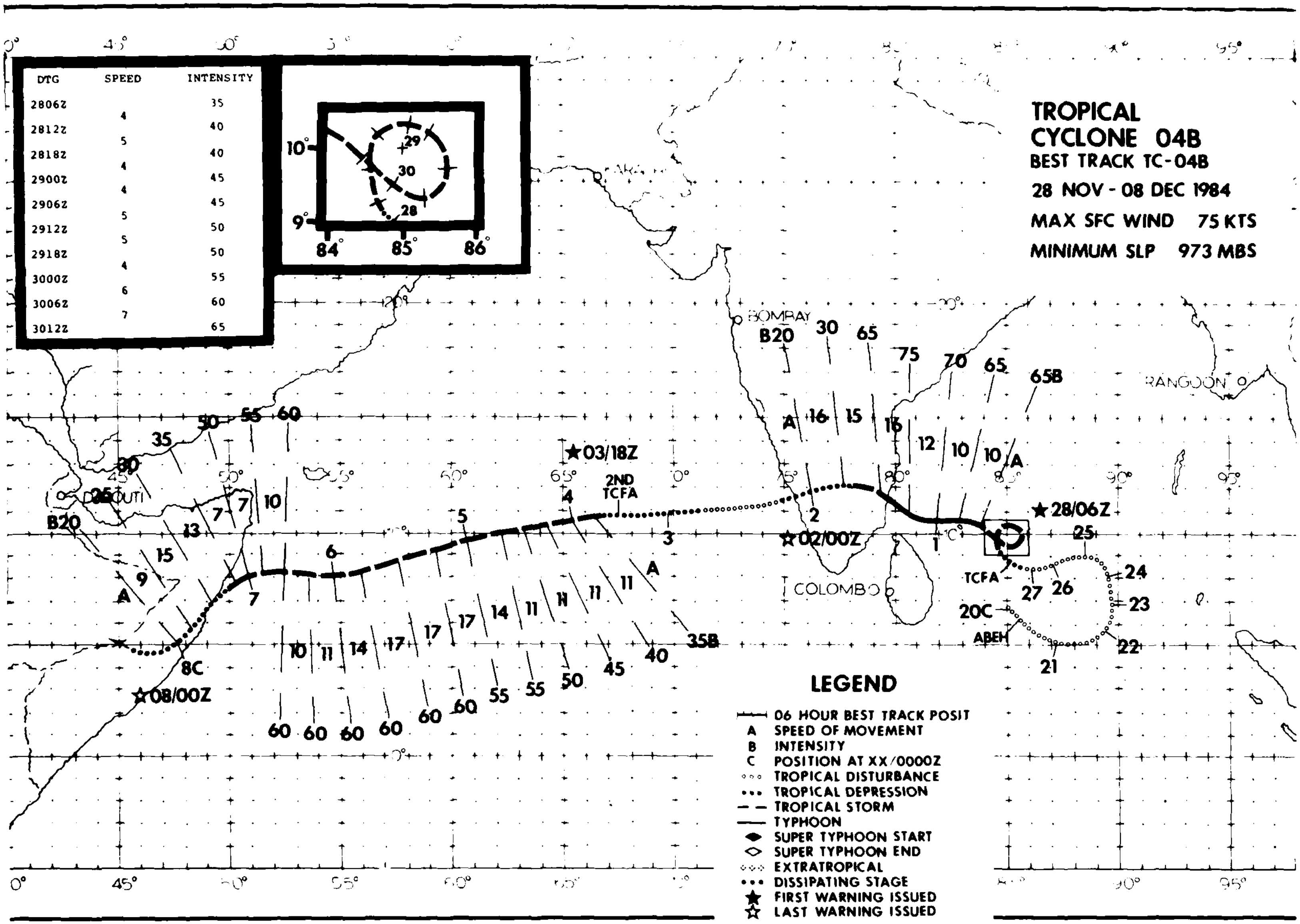


Figure 3-33-2. Tropical Cyclone 03B near maximum intensity (130427Z November DMSP visual imagery).

On 14 November, strong upper-level southwesterlies began to exert pressure on the storm. As a result, the convection began to be displaced to the northeast. Gradual weakening followed under this shearing environment until the storm made landfall where final dissipation occurred.

Unfortunately, the erratic movement and intensification of Tropical Cyclone 03B occurred very close to the east coast of India and brought a prolonged period of heavy rain and flooding to much of the region. At least 430 are known dead as a result of the storm. Over 20,000 people were stranded in coastal villages due to flooding.

At 150600Z the last warning was issued as the nearly convection-free low-level center dissipated over land just south of Nellore (WMO 43245).



DTG	SPEED	INTENSITY
2806Z		35
2812Z	4	40
2818Z	5	40
2900Z	4	45
2906Z	4	45
2912Z	5	50
2918Z	5	50
3000Z	4	55
3006Z	6	60
3012Z	7	65

Tropical Cyclone 04B was the last tropical cyclone of 1984 to develop in the North Indian Ocean. Like two of the three storms before it, Tropical Cyclone 04B distinguished itself by its unusual track.

Early on 20 November a large area of convection extended from the southern Bay of Bengal across the equator into the South Indian Ocean. There were two weak low-level circulations associated with this convection - one on either side of the equator. Although the convection showed no organization at this time, it was extensive in size; extending from 12N to 12S and from 70E to 100E. The most intense convection was near the equator where northwest low-level flow from the northern hemisphere converged with southwest flow from the southern hemisphere.

The tropical disturbance that was to become Tropical Cyclone 04B first appeared as an organized area of convection within the broad area near 6N 85.5E. The area was mentioned on the 200600Z Significant Tropical Weather Advisory (ABEH PGTW) and was given a "poor" potential for development into a significant tropical cyclone during the next 24 hours.

The broad disturbance persisted during the next five days and by 0600Z on the 25th, the two surface circulations on either side of the equator had moved further apart and were becoming more organized. Upper-level outflow over the area appeared weak but diffluent.

By 270600Z, the disturbance in the Bay of Bengal had reached tropical depression strength and had become more organized. This was indicated on satellite imagery by convective banding and the presence of anticyclonic upper-level outflow. This system was now judged to have "fair" potential for significant tropical cyclone development during the next 24 hours. During the next 12 hours the intensity and organization of the convection continued to increase prompting the issuance of a TCFA valid at 271900Z.

At 280600Z, the system had further intensified with Dvorak intensity analysis indicating that surface winds of 35 kt (18 m/s) were present. The disturbance now had a central core of intense convection. This prompted the first warning on Tropical Cyclone 04B to be issued at 280600Z.

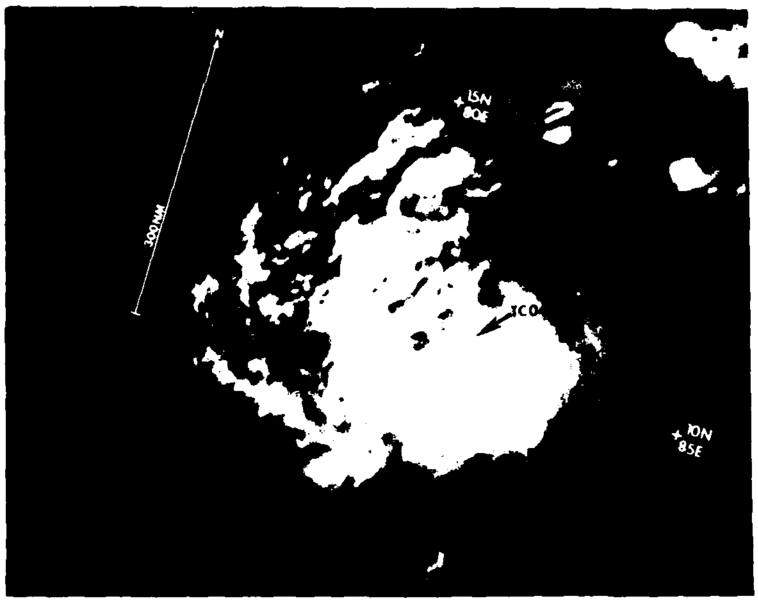


Figure 3-34-1. Tropical Cyclone 04B near maximum intensity (010509Z December DMSP visual imagery).

During the next 48 hours, Tropical Cyclone 04B moved in a slow anticyclonic loop while steadily intensifying. At 301200Z November, it had completed its loop and was estimated to have sustained surface winds of 65 kt (33 m/s). Once again this was based solely on the Dvorak intensity analysis of satellite imagery.

Tropical Cyclone 04B moved west during the next 18 hours, accelerated slightly and intensified to a peak intensity of 75 kt (39 m/s) (Figure 3-34-1). It then made a slight turn to the west-northwest and accelerated further to 16 kt (30 km/hr) as it made landfall on the east coast of India 40 nm (74 km) north of Nagappattinam (WMO 43340) at 011000Z December. After making landfall, the low-level circulation moved west across the southern tip of India and rapidly weakened. The mid-to-upper level circulation, however, took a more northwestward track and became displaced from the low-level center by approximately 120 nm (222 km). Warning status was terminated on Tropical Cyclone 04B at 020000Z since the system had no convection associated with it and the low-level circulation was weak and poorly defined.

This weak but persistent low-level circulation now turned to the west-southwest, entered the Arabian Sea and slowly redeveloped (Figure 3-34-2). By the 3rd of December, the convection was redeveloping near the low-level center and reintensification appeared likely. This prompted the issuance of a second TCFA at 031200Z. The system continued to intensify and warning status was resumed at 031800Z December.

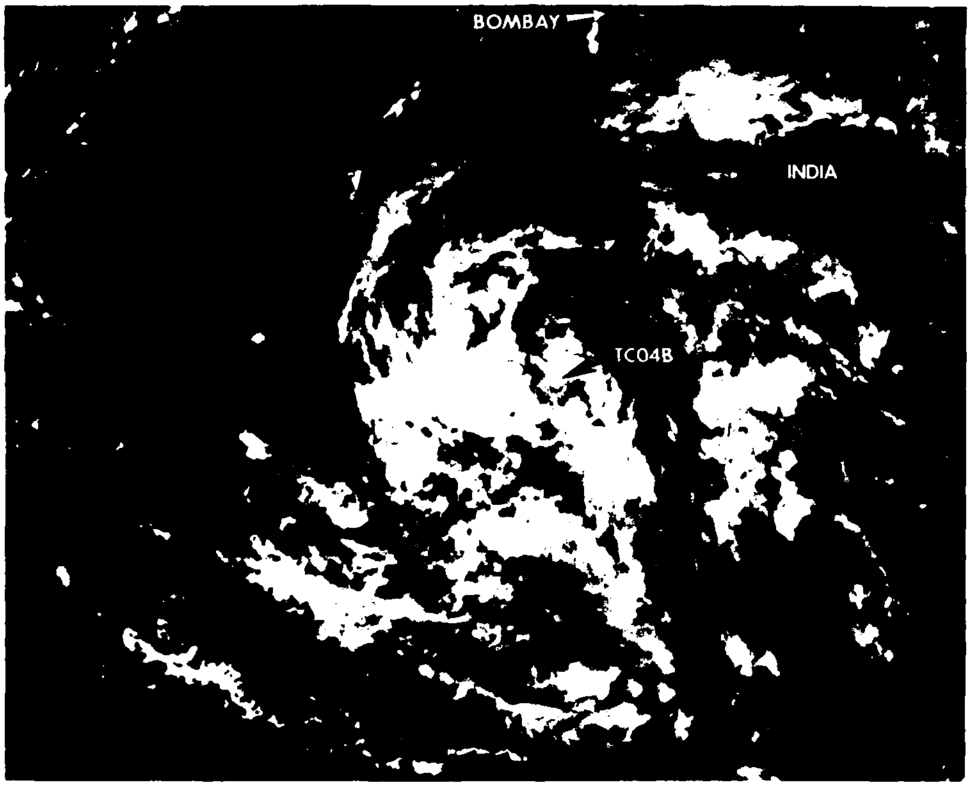


Figure 3-34-2. The poorly organized remnants of Tropical Cyclone 04B as it entered the Arabian Sea and began to reintensify (020448Z December DMSP visual imagery).

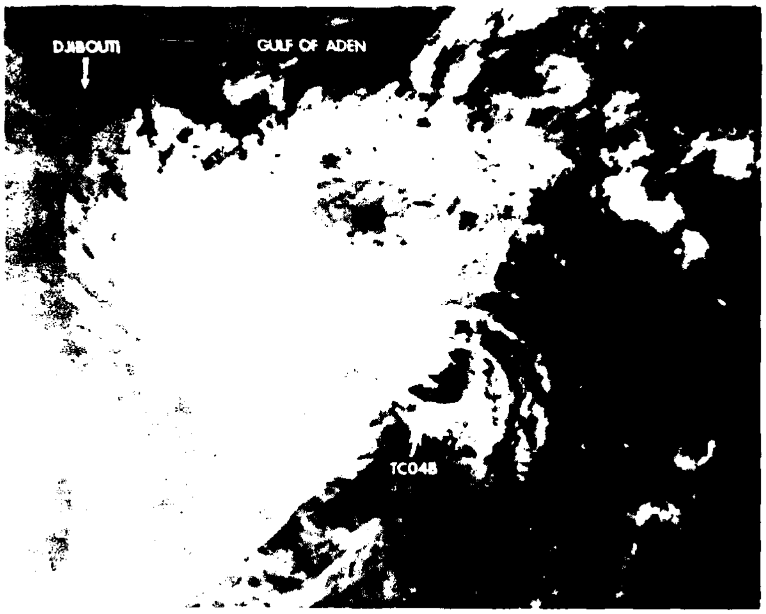


Figure 3-34-3. The exposed low-level circulation of Tropical Cyclone 04B located just off the east coast of Somalia (070630Z December DMSP visual imagery).

Tropical Cyclone 04B continued to move west-southwest, reaching an intensity of 60 kt (31 m/s) at 050600Z. For the next 42 hours it moved in a general westerly direction across the Arabian Sea around the southern periphery of a low to mid-level anticyclone located near the Persian Gulf. There was no significant change in intensity during this period.

At 070600Z, Tropical Cyclone 04B was within 25 nm (46 km) of the Somalia coast and had weakened to 35 kt (18 m/s) (Figure 3-34-3). At this point, the low-level circulation, became exposed, moved inland, and then moved southwestward along the coast for 24 hours before dissipating over land. The mid-to-upper level circulation and associated convection moved off to the northwest. The final warning was issued at 080000Z.

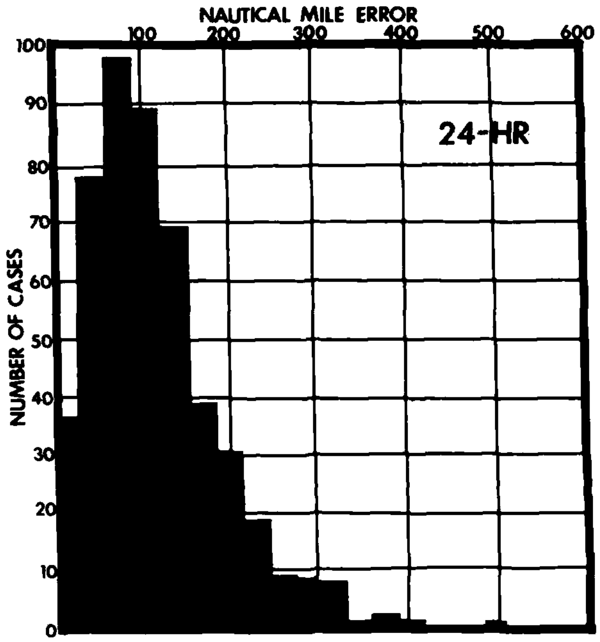
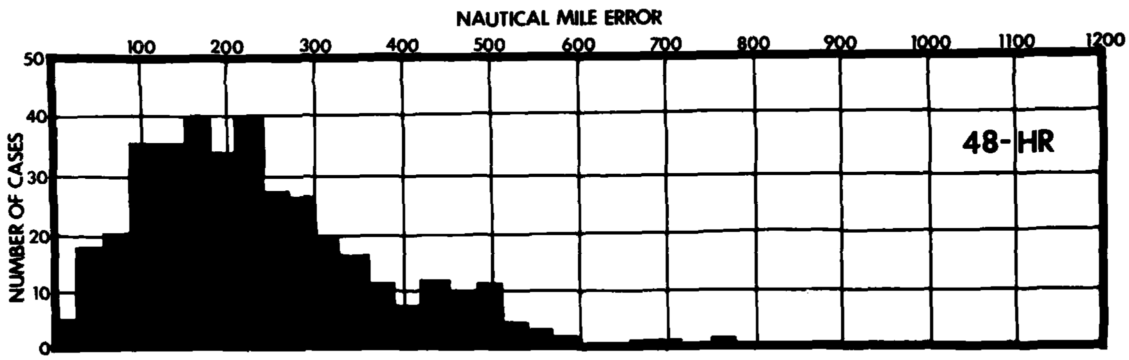


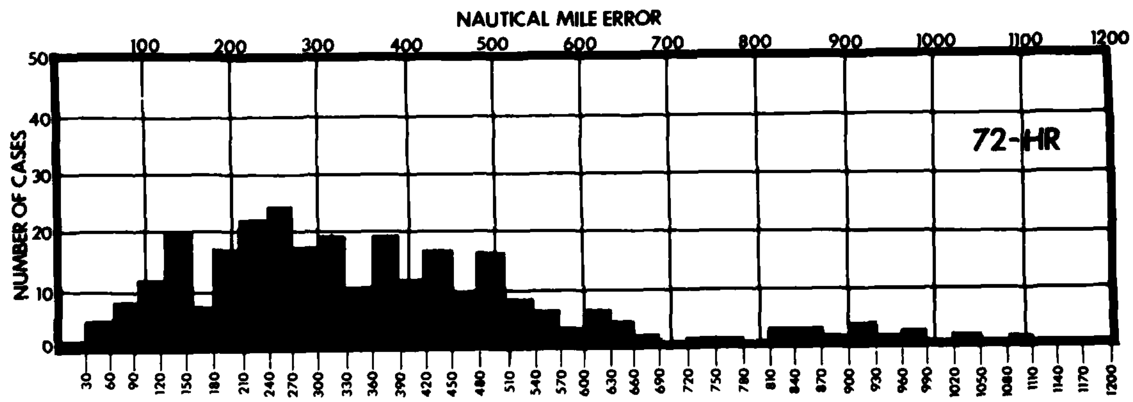
Figure 4-2

Frequency distribution of the 24-, 48-, and 72-hour forecast errors in 30 nm increments for all significant tropical cyclones in the western North Pacific during the 1984 season.

FORECAST ERRORS (nm)

	24-HR	48-HR	72-HR
MEAN:	117	233	363
MEDIAN:	101	211	316
STANDARD DEVIATION:	77	135	221
CASES:	492	378	286





CHAPTER IV - SUMMARY OF FORECAST VERIFICATION

1. ANNUAL FORECAST VERIFICATION

a. Western North Pacific Ocean

The positions given for warning times and those at the 24-, 48-, and 72-hour forecast times were verified against the post-analysis "best track" positions at the same valid times. The resultant vector and right angle (track) errors (illustrated in Figure 4-1) were then calculated for each tropical cyclone and are presented in Table 4-1. Figure 4-2 provides the frequency distributions of vector errors in 30 nm increments for 24-, 48-, and 72-hour forecasts of all 1984 tropical cyclones in the western North Pacific. A summation of the mean vector and right angle errors, as calculated for all tropical cyclones in each year, is shown in Table 4-2. A comparison of the annual mean vector errors for all tropical cyclones as compared to those tropical cyclones that reached typhoon intensity can be seen directly in Table 4-3. The annual mean vector errors for 1984 as compared to the ten previous years are graphed in Figure 4-3.

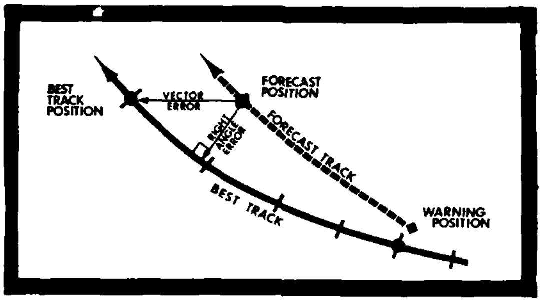


Figure 4-1. Illustration of the method to determine vector error and right angle error.

TABLE 4-1.

FORECAST ERROR SUMMARY FOR THE WESTERN NORTH PACIFIC SIGNIFICANT TROPICAL CYCLONES OF 1984. (ERRORS IN NM)

			WARNING			24-HOUR			48-HOUR			72-HOUR		
			VECTOR ERROR	RT ANGLE ERROR	NR OF WRNGS	VECTOR ERROR	RT ANGLE ERROR	NR OF WRNGS	VECTOR ERROR	RT ANGLE ERROR	NR OF WRNGS	VECTOR ERROR	RT ANGLE ERROR	NR OF WRNGS
01W.	TS	VERNON	31	28	9	116	86	[illegible]	147	55	1			
02W.	TS	WYNNE	14	10	28	93	44	24	224	114	18	389	224	16
03W.	TY	ALEX	27	23	18	155	[illegible]	14	351	197	10	803	328	6
04W.	TS	BETTY	13	9	12	72	42	10	105	46	5	83	80	2
05W.	TY	CARY	13	7	30	92	56	26	190	149	22	282	246	18
06W.	TY	DINAH	20	11	35	142	73	29	336	178	25	564	284	23
07W.	TY	ED	12	9	28	140	82	23	232	117	14	246	125	10
08W.	TS	FREDA	30	20	12	163	81	9	328	218	8	448	283	6
09W.	TD	09W	122	105	10	297	248	6	420	296	2			
10W.	TS	GERALD	25	9	24	136	57	20	311	123	16	331	[illegible]	[illegible]
11W.	TY	POLLY	16	11	25	111	73	21	230	149	17	423	316	13
12W.	TD	12W	46	8	5	204	16	1						
13W.	TY	IKE	13	10	42	80	63	33	174	149	35	[illegible]	242	31
14W.	TS	JUNE	70	28	11	121	104	8	125	85	4			
15W.	TY	KELLY	27	14	18	225	121	14	302	159	10	244	201	[illegible]
16W.	TS	LYNN	26	21	14	112	63	10	231	178	6	402	362	[illegible]
17W.	TS	MAURY	28	18	13	215	82	9	421	221	5	447	[illegible]	1
18W.	TS	NINA	30	12	15	156	37	9	279	85	5	482	146	3
19W.	TY	OGDEN	10	15	12	227	100	8	620	219	4			
20W.	TY	PHYLLIS	15	12	13	113	23	9	233	120	5	498	113	1
21W.	TS	ROY	21	19	9	173	87	5	207	179	1			
22W.	TS	SUSAN	13	9	5	47	25	1						
23W.	TD	23W	13	16	4									
24W.	TY	THAD	19	18	21	114	86	17	286	178	12	635	319	8
25W.	STY	VANESSA	14	11	31	102	68	27	179	106	23	245	165	19
26W.	TY	WARREN	21	9	31	95	53	29	265	128	27	353	213	23
27W.	TY	AGNES	11	7	28	72	23	25	139	54	21	197	69	18
28W.	STY	BILL	20	9	52	98	50	46	226	141	41	406	297	39
29W.	TY	CLARA	20	13	30	94	61	26	185	93	22	265	131	18
30W.	TY	DOYLE	13	10	26	69	58	22	193	161	19	397	310	15
ALL FORECASTS:			22	14	611	117	66	492	213	137	178	363	231	286

TABLE 4-2.

ANNUAL MEAN FORECAST ERRORS (NM) FOR THE WESTERN NORTH PACIFIC

	24-HOUR		48-HOUR		72-HOUR	
YEAR	VECTOR	RIGHT ANGLE	VECTOR	RIGHT ANGLE	VECTOR	RIGHT ANGLE
1971	111	64	212	118	317	117
1972	117	72	245	146	381	210
1973	108	74	197	134	253	162
1974	120	78	226	157	348	245
1975	138	84	288	181	450	290
1976	117	71	230	132	338	202
1977	148	83	283	157	407	228
1978	127	75	271	179	410	297
1979	124	77	226	151	316	223
1980	126	79	243	164	389	287
1981*	123	75	220	119	334	168
1982*	113	67	237	139	341	206
1983*	117	72	259	152	405	237
1984*	117	66	233	137	363	231

* The technique for calculating right angle error was revised in 1981; therefore, a direct correlation in right angle statistics cannot be made for the errors computed before 1981 and the errors computed since 1981.

TABLE 4-3. ANNUAL MEAN FORECAST ERRORS (NM) FOR WESTERN NORTH PACIFIC

	24-HOUR		48-HOUR		72-HOUR	
YEAR	ALL	TYPHOON*	ALL	TYPHOON*	ALL	TYPHOON*
1950-58		170				
1959		117**		267**		
1960		177**		354**		
1961		136		274		
1962		144		287		476
1963		127		246		374
1964		133		284		429
1965		151		303		418
1966		136		280		432
1967		125		276		414
1968		105		229		337
1969		111		237		349
1970	104	98	190	181	279	272
1971	111	99	212	203	317	308
1972	117	116	245	245	381	382
1973	108	102	197	193	253	245
1974	120	114	226	218	348	351
1975	138	129	288	279	450	442
1976	117	117	230	232	338	336
1977	148	140	283	266	407	390
1978	127	120	271	241	410	459
1979	124	113	226	219	316	319
1980	126	116	243	221	389	362
1981	123	117	220	215	334	342
1982	113	114	237	229	341	337
1983	117	110	259	247	405	384
1984	117	110	233	228	363	361

* for Typhoons only while winds were over 35 kt (18 m/sec).

** forecast positions north of 35°N were not verified.

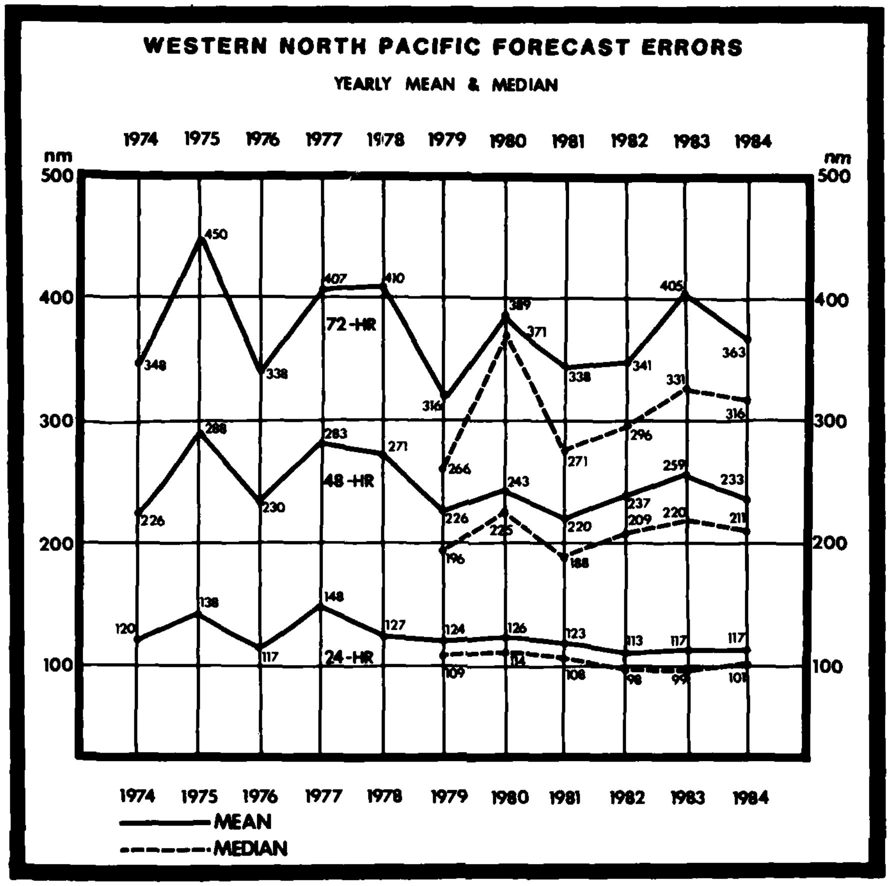


Figure 4-3. Annual mean and median vector errors (nm) for all tropical cyclones in the western North Pacific.

b. North Indian Ocean

The positions given for warning times and those at the 24-, 48-, and 72-hour valid times were verified for tropical cyclones in the North Indian Ocean by the same methods used for the western North Pacific. It should be noted that due to the low number of North Indian Ocean tropical cyclones, these error statistics should not be taken as representative of any trend.

Table 4-4 is the forecast error summary for the North Indian Ocean and Table 4-5 contains the annual average of forecast errors for each year through 1974. Vector errors are plotted in Figure 4-4. (Seventy-two hour forecast errors were evaluated for the first time in 1979). There were no verifying 72-hour forecasts in 1983.

TABLE 4-4.

FORECAST ERROR SUMMARY FOR THE NORTH INDIAN OCEAN
SIGNIFICANT TROPICAL CYCLONES FOR 1984. (ERRORS IN NM)

	WARNING			24-HOUR			48-HOUR			72-HOUR		
	POSIT ERROR	RT ANGLE ERROR	NR OF WRNGS	POSIT ERROR	RT ANGLE ERROR	NR OF WRNGS	POSIT ERROR	RT ANGLE ERROR	NR OF WRNGS	POSIT ERROR	RT ANGLE ERROR	NR OF WRNGS
01. TC 01A	31	19	9	225	79	5	347	195	1			
02. TC 02B	29	13	8	71	40	4						
03. TC 03B	26	16	16	132	107	9						
04. TC 04B	38	17	34	160	60	24	271	123	19	388	159	16
ALL FORECAST:	33	16	67	154	71	42	274	127	20	388	159	16

TABLE 4-5.

ANNUAL MEAN FORECAST ERRORS FOR THE NORTH INDIAN OCEAN

	24-HOUR		48-HOUR		72-HOUR	
YEAR	VECTOR	RIGHT ANGLE	VECTOR	RIGHT ANGLE	VECTOR	RIGHT ANGLE
1971*	232	-	410	-	-	-
1972*	224	101	292	112	-	-
1973*	182	99	299	160	-	-
1974*	137	81	238	146	-	-
1975	145	99	228	144	-	-
1976	138	108	204	159	-	-
1977	122	94	292	214	-	-
1978	133	86	202	128	-	-
1979	151	99	270	202	437	371
1980	115	73	93	87	167	126
1981**	109	65	176	103	197	73
1982**	138	66	368	175	762	404
1983**	117	46	153	67	-	-
1984**	154	71	274	127	388	159

* The western Bay of Bengal and the Arabian Sea were not included in the JTWC area of responsibility until the 1975 tropical cyclone season.

** The technique for calculating right angle error was revised in 1981; therefore, a direct correlation in right angle statistics cannot be made for the errors computed before 1981 and the errors computed since 1981.

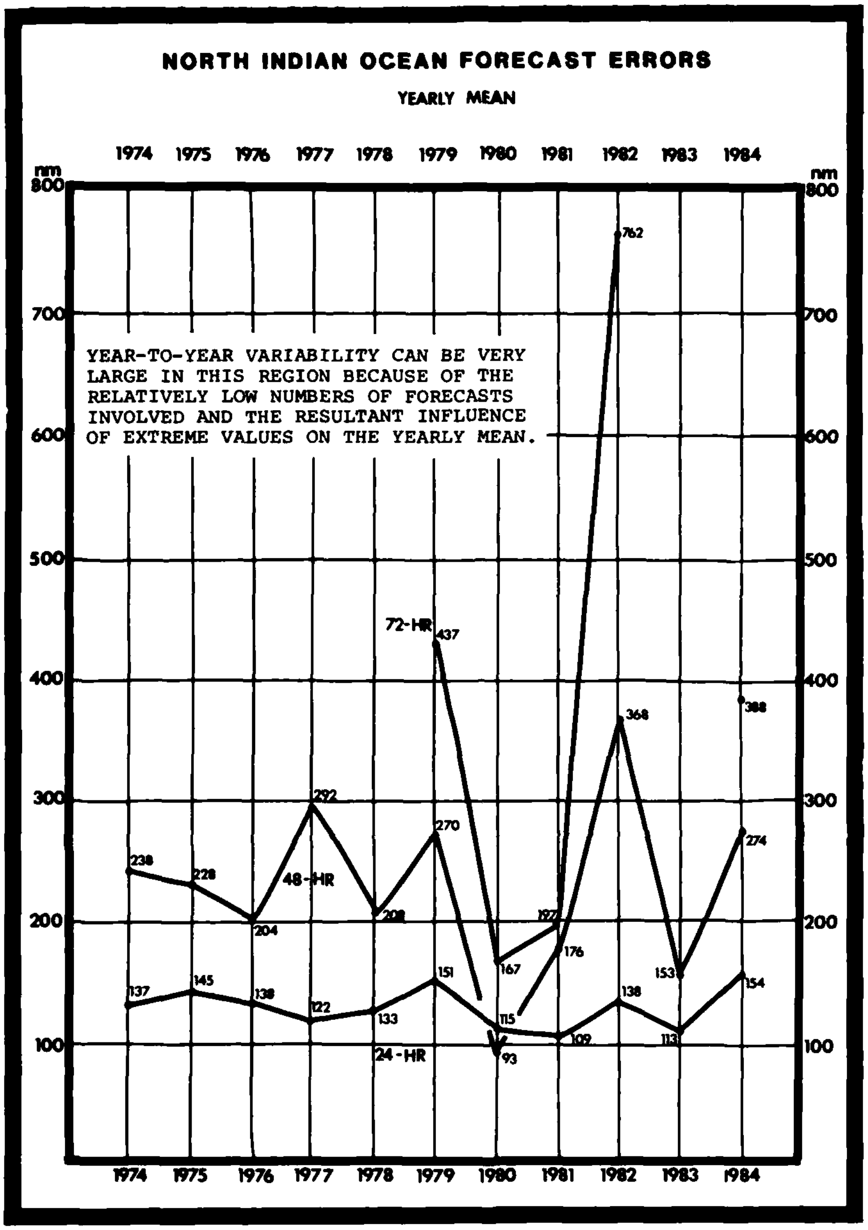


Figure 4-4. Annual mean vector errors (nm) for all tropical cyclones in the North Indian Ocean.

2. COMPARISION OF OBJECTIVE TECHNIQUES

a. General

Objective techniques used by JTWC are divided into five main catagories:

(1) extrapolation;

(2) climatological and analog techniques

(3) model output statistics;

(4) dynamical models; and

(5) empirical and analytical techniques

In September 1981, JTWC began to initialize its array of objective forecast techniques (described below) on the six-hour-old preliminary best track position (an interpolative process) rather than the forecast (partially extrapolated) warning position, e.g. the 0600Z warning is now supported by objective techniques developed from the 0000Z preliminary best track position. This operational change has yielded several advantages;

*techniques can now be requested much earlier in the warning development time line, i.e. as soon as the track can be approximated by one or more fix positions after the valid time of the previous warning;

*receipt of these techniques is virtually assured prior to development of the next warning; and

*improved (mean) forecast accuracy. This latter aspect arises because JTWC now has a more reliable approximation of the short-term tropical cyclone movement. Further, since most of the objective techniques are biased for persistence, this new procedure optimizes their performance and provides more consistent guidance on short-term movement, indirectly yielding a more accurate initial position estimate as well as lowering 24-hour forecast errors.

b. Description of Objective Techniques

(1) XTRP -- Forecast positions for 24- and 48-hours are derived from the extension of a straight line which connects the most-recent and 12-hour-old preliminary best track positions.

(2) CLIM -- A climatological aid providing 24-, 48-, and 72-hour tropical cyclone forecast positions (and intensity changes in the western North Pacific) based upon the position of the tropical cyclone. The output is based upon data records from 1945 to 1981 for the western North Pacific Ocean and 1900 to 1981 for the North Indian Ocean.

(3) TPAC -- Forecast positions are generated from a blend of climatology and persistence. The 24- and 48-hour positions are equally weighted between climatology and persistence and the 72-hour position is one quarter persistence and three quarters climatology. Persistence is a straight line extension of a line connecting the current and 12-hour-old positions. Climatology is based on data from 1945 to 1981 for the western North Pacific Ocean and 1900 to 1981 for the North Indian Ocean.

(4) TYAN78 -- An updated analog program which combines the earlier versions TYFN 75 and INJAN 74. The program scans a 30-year climatology with a similar history (within a specified acceptance envelope) to the current tropical cyclone. For the western North Pacific Ocean, three forecasts of position and intensity are provided for 24-, 48-, and 72-hours: RECR - a weighted mean of all accepted tropical cyclones which were catagorized as "recurving" during their best track period; STRA - a weighted mean of all accepted tropical cyclones which were catagorized as moving "straight" (westward) during their best track period; and TOTL - a weighted mean of all accepted tropical cyclones, including those used in the RECR and STRA forecasts. For the North Indian Ocean, a single (total) forecast track is provided for 12-hour intervals to 72 hours.

(5) COSMOS -- A model output statistics (MOS) routine based on the geostrophic steering at the 850-, 700-, and 500-mb levels. The steering is derived from the HATTRACK point advection model run on Global prognostic fields from the FLENUMOCEANCEN NOGAPS prediction system. The MOS forecast is then blended with the 6-hour past movement to generate the forecast track.

(6) OTCM -- (One-way Interactive Tropical Cyclone Model) A course-mesh, three-layer in the vertical, primative equation model with a 205 km grid spacing over a 6400 X 4700 km domain. The model's fields are computed around a bogused, digitized cyclone vortex using FLENUMOCEANCEN Numerical Variational Analysis (NVA) or NOGAPS prognostic fields for the specified valid time. The past motion of the tropical cyclone is compared to initial steering fields and a bias correction is computed and applied to the model. FLENUMOCEANCEN NOGAPS global prognostic fields are used at 12-hour intervals to update the model's boundaries. The resultant forecast positions are derived by locating the 850 mb vortex at six hour intervals to 72-hours.

(7) NTCM -- (Nested Tropical Cyclone Model) A primitive equation model with similar properties as the OTCM. The NTCM differs by containing a finer scale "nested" grid, initializing on NVA analysis fields only, not containing a (persistence) bias correction, and being a channel model which runs independent of FLENUMOCEANCEN prognostic fields (not requiring updating of its boundaries). The "nested grid" covers a 1200 X 1200 km area with a 41 km grid spacing which moves within the course-mesh domain to keep an 850 mb vortex at its center.

(8) TAPT -- An empirical technique which utilizes upper-tropospheric wind fields to estimate acceleration associated with the tropical cyclones interaction with the mid-latitude westerlies. It includes guidelines for duration of acceleration, upper-limits, and probable path of the cyclone.

(9) CLIP -- A statistical regression technique based on climatology, current intensity and position and past movement. This technique is used as a crude measure of real forecast skill when verifying forecast accuracy.

(10) THETA E -- An empirically derived relationship between a tropical cyclone's minimum sea-level pressure (MSLP) and 700 mb equivalent potential temperature (θe) was developed by Sikora (1976) and Dunnavan (1981). By monitoring MSLP and θe trends, the forecaster can evaluate the potential for sudden, rapid deepening of a tropical cyclone.

(11) WIND RADIUS -- Following an analytic model of the radial profiles of sea-level pressures and winds in mature tropical cyclones (Holland, 1980), a set of radii for 30-, 50-, and 100-knot winds based on the tropical cyclone's maximum winds have been produced to aid the forecaster in determing forecast wind radii.

(12) Dvorak -- An estimation of a tropical cyclone's current and 24-hour forecast intensity is made from interpolation of satellite imagery (Dvorak, 1973, 1982) and provided to the forecaster. These intensity estimates are used in conjunction with other intensity-related data and trends to forecast tropical cyclone intensity.

JTWC currently uses TPAC, TAPT, TYAN78, COSMOS, and OTCM operationally with NTCM in an evaluation mode to develop track forecasts.

c. Testing and Results

A comparison of mean and median forecast errors (for a non-homogeneous data set) is provided for selected techniques in Table 4-6 for all western North Pacific tropical cyclones and in Table 4-8 for all North Indian Ocean tropical cyclones.

A comparison of selected techniques is included in Table 4-7 for all western North Pacific tropical cyclones and in Table 4-9 for all North Indian Ocean tropical cyclones. In these tables, "X-AXIS" refers to techniques listed vertically. The example in Table 4-7 compares COSM to OTCM, i.e. in the 461 cases available for a (homogeneous) comparison, the average vector error at 24 hours was 125 nm for COSMOS and 129 nm for OTCM. The difference of 4 nm is shown in the lower right. (Differences are not always exact, due to computational round-off which occurs for each of the cases available for comparison).

TABLE 4-7. 1984 ERROR STATISTICS FOR SELECTED OBJECTIVE TECHNIQUES IN THE WESTERN NORTH PACIFIC OCEAN

24-HOUR FORECAST ERRORS (NM)

	JTWC		RECR		CLIP		TOTL		COSM		NTCM		OTCM		TPAC		CLIM		XTRP		HPAC	
JTWC	492	117																				
	117	0																				
RECR	459	115	472	130																		
	128	13	130	0																		
CLIP	409	117	392	130	422	120																
	119	2	117	-12	120	0																
TOTL	475	115	471	130	409	117	489	130														
	129	14	129	0	130	13	130	0														
COSM	473	117	456	129	408	119	473	130	486	125												
	122	6	123	-6	127	7	122	-6	125	0												
NTCM	421	117	404	130	421	120	421	130	420	126	435	121										
	120	3	119	-10	122	1	118	-11	120	-5	121	0										
OTCM	461	116	442	128	401	120	459	129	461	125	413	121	474	130								
	128	12	129	0	132	12	128	0	129	4	131	10	130	0								
TPAC	484	116	466	129	416	120	482	129	479	124	428	120	465	130	499	133						
	132	15	131	2	133	13	131	2	133	9	132	11	132	3	133	0						
CLIM	488	116	470	129	420	120	486	129	483	125	432	120	469	130	499	133	503	125				
	180	64	181	52	183	63	161	52	183	58	182	62	181	52	183	50	183	0				
XTRP	487	117	468	129	419	120	485	130	482	124	431	121	469	130	498	133	500	183	503	125		
	124	7	123	-6	126	6	123	-5	126	1	126	5	125	-4	125	-7	125	-57	125	0		
HPAC	485	116	467	129	417	120	483	129	480	124	429	120	466	130	498	133	500	183	500	125	500	133
	132	15	131	2	133	13	131	2	133	9	132	12	132	3	133	0	133	-49	133	8	133	0

NUMBER OF CASES	X-AXIS TECHNIQUE ERROR
Y-AXIS TECHNIQUE ERROR	ERROR DIFFERENCE Y - X

48-HOUR FORECAST ERRORS (NM)

	JTWC		RECR		CLIP		TOTL		COSM		NTCM		OTCM		TPAC		CLIM		XTRP		HPAC	
JTWC	378	233																				
	233	0																				
RECR	358	231	376	285																		
	277	46	285	0																		
CLIP	322	232	323	280	344	262																
	255	23	258	-21	262	0																
TOTL	366	230	374	285	325	257	389	288														
	283	53	284	0	282	26	288	0														
COSM	364	231	363	283	333	261	376	288	387	246												
	237	6	246	-36	248	-12	242	-45	246	0												
NTCM	331	231	332	280	343	262	344	283	342	246	353	257										
	252	21	255	-24	258	-2	251	-30	255	9	257	0										
OTCM	344	231	342	277	314	259	353	284	355	243	321	256	364	242								
	241	9	239	-37	245	-13	238	-44	239	-2	246	-9	242	0								
TPAC	372	230	371	283	340	260	383	285	381	246	349	257	358	243	395	284						
	277	47	281	-1	282	21	280	-4	284	38	281	24	281	38	284	0						
CLIM	375	231	374	284	343	261	386	286	384	246	352	257	361	242	395	284	398	363				
	353	122	358	74	360	99	360	74	363	117	359	102	360	118	362	78	363	0				
XTRP	374	232	372	284	341	261	385	288	383	246	350	257	360	242	394	284	395	363	397	290		
	281	49	286	2	293	32	286	0	292	46	291	34	286	43	289	5	290	-72	290	0		
HPAC	372	230	371	284	340	261	383	286	381	246	349	257	358	243	394	284	395	363	395	290	395	285
	278	47	282	-1	283	22	281	-4	285	39	281	25	281	39	284	0	285	-77	285	-4	285	0

JTWC - OFFICIAL JTWC FORECAST
RECR - RECURVER (TYAN 78)
CLIP - CLIPPER
TOTL - TOTAL (TYAN 78)
COSM - COSMOS (MOS)
NTCM - NESTLD TROPICAL CYCLONE MODEL
OTCM - ONE-WAY TROPICAL CYCLONE MODEL
TPAC - CLIM AND PERSISTENCE BLEND
CLIM - CLIMATOLOGY
XTRP - 12-HOUR EXTRAPOLATION
HPAC - MEAN OF XTRP AND CLIM

72-HOUR FORECAST ERRORS (NM)

	JTWC		RECR		CLIP		TOTL		COSM		NTCM		OTCM		TPAC		CLIM	
JTWC	286	363																
	363	0																
RECR	272	371	289	477														
	474	103	477	0														
CLIP	251	365	254	473	267	413												
	404	39	418	-54	413	0												
TOTL	278	366	288	477	261	414	296	470										
	464	98	474	-3	464	50	470	0										
COSM	277	358	280	473	259	411	287	467	295	389								
	386	28	397	-74	387	-22	393	-72	389	0								
NTCM	299	365	262	471	266	414	269	465	267	383	275	430						
	432	67	435	-35	432	18	433	-32	422	39	430	0						
OTCM	235	366	244	492	219	426	246	472	244	399	225	451	251	363				
	364	-1	364	-127	359	-66	364	-106	358	-39	361	-89	363	0				
TPAC	282	360	284	476	264	413	291	468	290	390	272	430	246	365	299	455		
	450	90	457	-17	499	37	453	-14	451	62	449	19	458	93	455	0		
CLIM	285	361	287	476	267	413	294	470	293	389	275	430	249	364	299	455	302	514
	513	152	515	39	508	95	512	42	511	122	506	76	519	156	513	58	514	0

TABLE 4-9. 1984 ERROR STATISTICS FOR SELECTED OBJECTIVE TECHNIQUES IN THE NORTH INDIAN OCEAN

NUMBER OF CASES	X-AXIS TECHNIQUE ERROR
Y-AXIS TECHNIQUE ERROR	ERROR DIFFERENCE Y - X

24-HOUR FORECAST ERRORS (NM)

	JTWC		TOTL		NTCM		OTCM		TPAC		CLIM		XTRP		HPAC	
JTWC	42	154														
	154	0														
TOTL	31	147	35	130												
	124	-21	130	0												
NTCM	36	162	29	144	43	161										
	160	-1	155	11	161	0										
OTCM	38	154	32	130	39	163	47	160								
	161	7	154	24	168	5	160	0								
TPAC	39	148	34	133	39	152	41	148	45	137						
	139	-8	143	10	146	-4	134	-13	137	0						
CLIM	39	148	34	133	39	152	41	148	45	137	45	183				
	189	41	191	58	181	30	181	33	183	46	183	0				
XTRP	42	154	35	130	43	161	46	160	45	137	45	183	50	138		
	133	-20	120	-10	147	-13	138	-21	134	-3	134	-48	138	0		
HPAC	39	148	34	133	39	152	41	148	45	137	45	183	45	134	45	142
	145	-2	149	16	146	-5	140	-8	142	5	142	-40	142	8	142	0

48-HOUR FORECAST ERRORS (NM)

	JTWC		TOTL		NTCM		OTCM		TPAC		CLIM		XTRP		HPAC	
JTWC	20	274														
	274	0														
TOTL	14	292	26	299												
	303	11	299	0												
NTCM	19	271	24	303	33	322										
	283	13	345	42	322	0										
OTCM	18	263	24	293	31	317	33	318								
	289	27	364	71	312	-4	318	0								
TPAC	19	285	26	299	32	325	32	325	34	308						
	359	73	307	8	310	-15	301	-23	308	0						
CLIM	19	285	26	299	32	325	32	325	34	308	34	387				
	466	181	379	80	384	59	372	47	387	79	387	0				
XTRP	20	274	26	299	33	322	33	318	34	308	34	387	35	282		
	272	-1	259	-39	287	-33	285	-31	285	-22	285	-101	282	0		
HPAC	19	285	26	299	32	325	32	325	34	308	34	387	34	285	34	308
	358	73	307	8	309	-15	301	-23	308	0	308	-78	308	23	308	0

JTWC - OFFICIAL JTWC FORECAST
TOTL - ANALOG (TYAN 78)
NTCM - NESTED TROPICAL CYCLONE MODEL
OTCM - ONE-WAY TROPICAL CYCLONE MODEL
TPAC - CLIM AND PERSISTENCE BLEND
CLIM - CLIMATOLOGY
XTRP - 12-HOUR EXTRAPOLATION
HPAC - MEAN OF XTRP AND CLIM

72-HOUR FORECAST ERRORS (NM)

	JTWC		TOTL		NTCM		OTCM		TPAC		CLIM	
JTWC	16	388										
	388	0										
TOTL	12	368	22	476								
	475	107	476	0								
NTCM	15	383	21	475	25	547						
	417	34	567	92	547	0						
OTCM	6	489	11	542	11	669	12	290				
	290	-198	304	-237	286	-382	290	0				
TPAC	16	388	22	476	25	547	12	290	26	566		
	616	229	545	69	553	5	669	379	566	0		
CLIM	16	388	22	476	25	547	12	290	26	566	26	629
	691	303	616	140	609	61	788	498	629	64	629	0

CHAPTER V - APPLIED TROPICAL CYCLONE RESEARCH SUMMARY

The following articles delineate the extent of the research program at Naval Environmental Prediction Research Facility (NAVENVPREDRSCHFAC) dedicated to supporting the operations at JTWC. There are three major research departments at NAVENVPREDRSCHFAC, each contributing to the overall program; research on current and future tropical cyclone models is performed in the Numerical Modeling Department, the Tactical Applications Department conducts statistical applications studies, and the Satellite Processing and Display Department develops computer interactive techniques.

THE NAVY TWO-WAY INTERACTIVE NESTED TROPICAL CYCLONE MODEL (NTCM)

(Fiorino, M., NAVENVPREDRSHFAC)

Two techniques for incorporating persistence into the NTCM forecast were tested on 157 independent cases from the 1982 and 1983 WESTPAC seasons. The first method uses the bias-corrector strategy in which the winds around the storm are modified to force the storm to initially move with the observed current motion. The bias-corrector is a pre-processing technique because the forecast track is affected before the model integration. The second method uses the post-processing technique of COSMOS. In this method, the 72-hour forecast position is retained and a combination of persistence and a straight line between the initial position and 72-hour point is used to fill in for the 24- and 48-hour positions. Superior results were obtained with the post-processing method. The median forecast errors at 24, 48, and 72 hours were 90, 201, and 296 nm compared to 102, 225, and 312 nm for the pre-processing method. Although the bias-corrector degraded the median 72-hour forecast error of the NTCM, it was effective in reducing the speed bias.

One-Way influence boundary conditions have been built into the NTCM. The initialization of the large-scale flow and the vortex were also modified to accommodate the change to the lateral boundary conditions. Experiments are underway to determine how the time variation of the flow at the boundaries affects the forecast track. The new version of the NTCM with one-way boundaries will be ready for the 1985 WESTPAC season.

TROPICAL CYCLONE SYNOPTIC ANALYSIS DISPLAY SYSTEM

(Tsui, T., NAVENVPREDRSCHFAC)

A new SPADS software is under development for the purpose of demonstrating that the existing computer softwares can be adapted for SPADS and be streamlined together to provide tropical cyclone forecasters a means to investigate immediate synoptic situation changes. This new SPADS system will be able to process satellite IR, VIS, and microwave data as they become available and translate these digital data into meteorological information which is to be merged with the FNOC wind/height field analysis. To maximize the utility of the system, the modified wind/height field should be updated every three hours so the forecasters could detect the most recent changes in the synoptic-scale flow influencing the tropical cyclone movement.

TROPICAL CYCLONE OBJECTIVE DECISION-TREE FORECASTING AID

(Elsberry, R. L. and J. Chan, NAVPGSCOL)

In view of the short tour length and limited forecast experience of many JTWC TDO's, an objective approach to the tropical cyclone track forecasting decision making process is desired. Forecasters need assistance in determining when, where, and how to use the objective aids. A research effort is now underway to study the performance of different tropical cyclone forecast aids for various cyclone characteristics under different environmental conditions. Each of the factors, including center fix errors, affecting the accuracy of objective forecast aids will be incorporated into a decision tree to assist the forecaster in following a logical and reasonable path in selecting appropriate aids in any given situation. In FY85, NTCM will be used as a test case to prove the concept.

JTWC CLIMATOLOGICAL DATA SET

(Tsui, T., NAVENVPREDRSCHFAC)

The JTWC tropical cyclone data base has been updated and expanded. The data base resides on FNOC computer disks on a storm-by-storm basis containing fix data, best track information, and official and objective aid forecasts. All three data sets have a separate but consistent data format. The data period begins at 1966 for the fix data, 1945 for the best track information, and 1967 for the official and objective aid forecasts. Currently, the last year included in this data set is 1983.

A STATISTICAL METHOD FOR 1 to 3 DAY TROPICAL CYCLONE TRACK PREDICTION

(Matsumoto, C. R. and W. M. Gray, Colorado State University)

Growing out of the Colorado State University's own research effort, a new

method of incorporating climatology, persistence and synoptic data to forecast the 1 to 3 day tropical cyclone motion has been developed in an attempt to improve the accuracy of track prediction. Cyclones are stratified based on their position relative to the 500 mb subtropical ridge to better define the environmental influences on the cyclones. The 72-hr track forecast is segmented into three 24-hr time steps to permit the application of updated persistence and synoptic data relative to the new cyclone position as the 24-hr displacements are stepped forward to the desired forecast projection. Since the initial results warrant further investigations, NAVENVPREDRSCHFAC will evaluate the program under a simulated operational environment in FY85.

TROPICAL CYCLONE HAVEN STUDIES

(Brand, S. NAVENVPREDRSCHFAC)

With the completion of seven new hurricane haven studies, the Hurricane Havens Handbook for the North Atlantic Ocean provides 22 port and harbor evaluations. In addition, the haven study for Pearl Harbor has been completed and published. Requests for copies for official use may be directed to Commanding Officer, Attn: Technical Library, Naval Environmental Prediction Research Facility, Monterey, CA 93943-5106. Registered qualified users may request copies from Director, Defense Technical Information Center, Cameron Station, Alexandria, VA 22314. Others may purchase copies from National Technical Information Service, U. S. Department of Commerce, Springfield, VA 22151.

NAVY TACTICAL APPLICATIONS GUIDE (MTAG), Vol. 6

(Fett, R., NAVENVPREDRSCHFAC)

An effort is now underway to develop a series of examples demonstrating the use of high quality satellite data for analysis and forecasting in the tropics. Both polar orbital and geostationary satellite data are used to study the evolution of certain weather effects or of a particular weather phenomenon at a given time. These examples are intended for publishing in the NTAG Volume 6, Part I, Tropical Weather Analysis and Forecast Applications, and Volume 6, Part II, Tropical Cyclone Weather Analysis and Forecast Applications. This NTAG Volume 6 is scheduled to be published in 1988.

STATISTICAL TROPICAL CYCLONE FORECASTING AIDS FOR THE SOUTHERN HEMISPHERE

(Keenan, T., Bureau of Meteorology, Australia)

Statistical models for forecasting Southern Hemisphere tropical cyclones have been adapted and developed. From a limited sample test, it is apparent that the Australian aids provide a level of assistance similar to the JTWC aids. The forecast errors of the Australian statistical aids range from 111 to 148 nm for 24-hr forecast and from 215 to 252 nm for 48-hr forecast. The classical regression technique turns out to be the best aid. This regression technique is derived from prescreened data sets which consist of 1000, 850, 700, 500, and 300 mb height fields, climatology predictors and persistence predictors. All the Australian aid programs reside on JTWC disk files in the FNOC computer system. Forecasters can activate these aids by providing date-time-group, previous and current storm locations and intensities.

SATELLITE BASED TROPICAL CYCLONE INTENSITY FORECASTS

(Cook, J. and T. Tsui, NAVENVPREDRSCHFAC)

An objective spiral analysis technique for tropical cyclone intensity forecasting has been installed on the Satellite Data Processing And Display System (SPADS). Through the satellite IR image displayed by SPADS, the technique first accepts a user described outline of a major cloud band of the tropical cyclone. The technique then objectively finds the best fitting spherical logarithmic spiral to the cloud band, and performs multiple Fourier analyses of the radiance field along orthogonal spirals to the band. By using these Fourier coefficients along with climatology and persistence predictors, tropical cyclone intensity forecasts can be deduced from regression equations. Independent tests show that the spiral technique possesses remarkably better skill in estimating the current intensity (6 kts RMS errors) than the Dvorak technique (15 kts RMS errors). Also, the spiral technique has a reliable 12-hr intensity forecasting skill (14 kts RMS errors).

CHARACTERISTICS OF NORTH INDIAN OCEAN TROPICAL CYCLONE ACTIVITY

(Lee, C. S. and W. M. Gray, Colorado State University)

A detailed individual case analysis is made of each of the North Indian Ocean (NIO) tropical cylcones which occurred during the 1979 First GARP GlobalExperiment (FGGE) period. Each NIO tropical cyclone's characteristics from genesis to decay are discussed. These tropical cyclones are found to form almost exclusively within the monsoon trough. Low-level equatorial westerly winds and Southern Hemisphere influences appear more important for the NIO tropical cyclones than for monsoon trough tropical cyclone formations in other regions. However, their basic structure, intensity change, and movement characteristics are very similar to tropical cyclones occurring in the other regions. A NAVENVPREDRSCHFAC technical report of this study will be published in early 1985.

TROPICAL CYCLONE READINESS CONDITION SETTING PROGRAM

(Brand, S. NAVENVPREDRSCHFAC and Jarrel, J., Science Applications, Inc.)

A procedure for setting tropical cyclone readiness conditions with a high degree of reliability has been developed. The methodology utilizes a large number of computer-simulated forecasts for actual tropical cyclones since 1899 that passed near Key West, FL and Guantanamo Bay, Cuba. Wind probabilities were computed from these forecasts assuming present-day official forecast error characteristics, and then compared to hindsight estimates of actual winds. These data were used to establish tropical cyclone condition thresholds at desired levels of confidence as related to wind probability. Sample nomographs with 95% threshold confidence values have been developed for hurricane readiness conditions at Key West and Guantanamo Bay. In the coming year, the readiness condition setting program will be adapted for five Pacific sites (Subic Bay, Buckner Bay, Yokosuka, Guam, and Pearl Harbor). In addition, this program will be developed for the afloat units in the Pacific area.

ANNEX A
TROPICAL CYCLONE TRACK AND FIX DATA

1. WESTERN NORTH PACIFIC CYCLONE DATA

TROPICAL STORM VERNON
BEST TRACK DATA

	BEST TRACK		WARNING				24 HOUR FORECAST				48 HOUR FORECAST				72 HOUR FORECAST			
					ERRORS				ERRORS				ERRORS				ERRORS	
MO/DA/HR	POSIT	WIND	POSIT	WIND	DST	WIND	POSIT	WIND	DST	WIND	POSIT	WIND	DST	WIND	POSIT	WIND	DST	WIND
060718Z	11.9 114.8	20	0.0 0.0	0	-0	0	0.0 0.0	0	-0	0	0.0 0.0	0	-0	0	0.0 0.0	0	-0	0
060800Z	12.1 114.2	25	0.0 0.0	0	-0	0	0.0 0.0	0	-0	0	0.0 0.0	0	-0	0	0.0 0.0	0	-0	0
060806Z	12.3 113.7	25	0.0 0.0	0	-0	0	0.0 0.0	0	-0	0	0.0 0.0	0	-0	0	0.0 0.0	0	-0	0
060812Z	12.6 113.3	25	0.0 0.0	0	-0	0	0.0 0.0	0	-0	0	0.0 0.0	0	-0	0	0.0 0.0	0	-0	0
060818Z	13.0 113.0	30	0.0 0.0	0	-0	0	0.0 0.0	0	-0	0	0.0 0.0	0	-0	0	0.0 0.0	0	-0	0
060900Z	13.4 112.7	30	13.3 112.6	30	8	0	15.0 111.1	40	88	5	16.9 109.6	50	147	25	0.0 0.0	0	-0	0
060906Z	14.2 112.2	35	14.0 112.2	35	12	0	16.4 110.6	45	105	10	0.0 0.0	0	-0	0	0.0 0.0	0	-0	0
060912Z	14.9 111.9	40	14.9 111.7	40	12	0	17.4 109.1	45	89	15	0.0 0.0	0	-0	0	0.0 0.0	0	-0	0
060918Z	15.5 111.1	40	15.5 111.2	40	6	0	18.1 109.0	45	135	15	0.0 0.0	0	-0	0	0.0 0.0	0	-0	0
061000Z	15.9 109.9	35	16.2 110.4	40	34	5	19.0 108.1	35	166	10	0.0 0.0	0	-0	0	0.0 0.0	0	-0	0
061006Z	16.1 108.8	35	16.5 109.1	35	30	0	0.0 0.0	0	-0	0	0.0 0.0	0	-0	0	0.0 0.0	0	-0	0
061012Z	16.2 108.2	30	17.1 108.4	35	55	5	0.0 0.0	0	-0	0	0.0 0.0	0	-0	0	0.0 0.0	0	-0	0
061018Z	16.3 107.6	30	17.8 107.7	30	90	0	0.0 0.0	0	-0	0	0.0 0.0	0	-0	0	0.0 0.0	0	-0	0
061100Z	16.4 107.1	25	17.0 107.0	25	36	0	0.0 0.0	0	-0	0	0.0 0.0	0	-0	0	0.0 0.0	0	-0	0

	ALL FORECASTS				TYPHOONS WHILE OVER 35 KTS			
	WRNG	24-HR	48-HR	72-HR	WRNG	24-HR	48-HR	72-HR
AVG FORECAST POSIT ERROR	31	116	147	0	0	0	0	0
AVG RIGHT ANGLE ERROR	28	86	55	0	0	0	0	0
AVG INTENSITY MAGNITUDE ERROR	1	11	25	0	0	0	0	0
AVG INTENSITY BIAS	1	11	25	0	0	0	0	0
NUMBER OF FORECASTS	9	5	1	0	0	0	0	0

DISTANCE TRAVELED BY TROPICAL CYCLONE IS 556. NM

AVERAGE SPEED OF TROPICAL CYCLONE IS 7 KNOTS

TROPICAL STORM VERNON
FIX POSITIONS FOR CYCLONE NO 1

SATELLITE FIXES

	FIX NO.	TIME (Z)	FIX POSITION	ACCRY	DVORAK CODE	COMMENTS	SITE
	1	070215	12.1N 114.7E	PCN 5	T1 5/1 5	ULAC 9 6N 113 8E	RPMK
	2	080155	11.8N 114.1E	PCN 5	T2 0/2 0 /D0 5/24HRS		RPMK
*	3	080729	11.4N 114.4E	PCN 5	T1 0/1 0	INIT OBS	PGTW
	4	080729	12.6N 113.6E	PCN 5			RPMK
	5	081435	12.9N 113.6E	PCN 5			RPMK
*	6	082014	12.0N 113.7E	PCN 5			RODN
	7	082100	13.4N 112.8E	PCN 6			PGTW
	8	082356	13.3N 111.5E	PCN 5	T2 0/2 0	INIT OBS	RODN
	9	090000	13.4N 112.5E	PCN 5	T2 0/2 0	INIT OBS	PGTW
	10	090135	13.4N 112.9E	PCN 5	T2 0/2 0-/S0 0/24HRS	EXP LLCC	RPMK
	11	090300	14.1N 112.5E	PCN 4		EXP LLCC	PGTW
	12	090316	14.3N 112.5E	PCN 3	T2 5/2 5-/D0 5/23HRS	EXP LLCC	RPMK
	13	090716	14.4N 112.1E	PCN 3		EXP LLCC	PGTW
	14	091025	14.7N 111.8E	PCN 5			PGTW
*	15	091235	15.6N 113.0E	PCN 6			RPMK
	16	091500	14.9N 111.7E	PCN 6			PGTW
	17	091800	15.4N 111.2E	PCN 6			PGTW
	18	092001	14.8N 109.2E	PCN 5			RODN
	19	092100	16.0N 111.0E	PCN 6			PGTW
	20	092306	15.8N 109.6E	PCN 6	T2 0/2.5 /W0 5/20HRS		RPMK
	21	100000	15.8N 110.0E	PCN 6	T2 5/2 5-/D0 5/24HRS		PGTW
	22	100256	15.9N 109.3E	PCN 5	T2 0/2 5 /W0 5/24HRS		RPMK
	23	100300	16.1N 109.2E	PCN 4		EXP LLCC	PGTW
*	24	101214	16.7N 107.2E	PCN 5			RPMK
	25	102243	16.7N 107.1E	PCN 6			RPMK
	26	110000	16.2N 107.2E	PCN 6			PGTW

NOTICE - THE ASTERISKS (*) INDICATE FIXES UNREPRESENTATIVE AND NOT USED FOR BEST TRACK PURPOSES

TROPICAL STORM WYNNE
BEST TRACK DATA

	BEST TRACK		WARNING		ERRORS		24 HOUR FORECAST		ERRORS		48 HOUR FORECAST		ERRORS		72 HOUR FORECAST		ERRORS	
MO/DA/HR	POSIT	WIND	POSIT	WIND	DST	WIND	POSIT	WIND	DST	WIND	POSIT	WIND	DST	WIND	POSIT	WIND	DST	WIND
061806Z	20.5 135.1	20	0.0 0.0	0	-0	0	0.0 0.0	0	-0	0	0.0 0.0	0	-0	0	0.0 0.0	0	-0	0
061812Z	20.6 134.6	25	0.0 0.0	0	-0	0	0.0 0.0	0	-0	0	0.0 0.0	0	-0	0	0.0 0.0	0	-0	0
061818Z	20.6 134.1	25	0.0 0.0	0	-0	0	0.0 0.0	0	-0	0	0.0 0.0	0	-0	0	0.0 0.0	0	-0	0
061900Z	20.8 133.4	25	0.0 0.0	0	-0	0	0.0 0.0	0	-0	0	0.0 0.0	0	-0	0	0.0 0.0	0	-0	0
061906Z	21.2 132.8	30	21.1 132.5	30	18	0	23.2 130.9	40	66	0	25.6 130.5	45	233	0	28.2 130.5	40	415	-10
061912Z	21.3 132.2	30	21.1 131.5	35	41	5	22.2 129.2	45	28	0	23.9 126.8	60	106	10	25.9 124.6	60	226	10
061918Z	21.7 131.6	35	21.2 130.7	35	59	0	22.2 128.2	50	46	5	23.8 125.7	65	126	15	25.7 123.4	70	228	20
062000Z	22.0 131.0	35	21.9 130.9	35	8	0	23.2 128.7	55	49	10	24.5 126.5	65	134	15	26.0 124.5	70	236	15
062006Z	22.2 130.4	40	22.1 130.3	45	8	5	23.5 127.3	60	67	15	25.0 125.2	70	177	20	27.3 123.4	80	313	25
062012Z	22.3 129.7	45	22.4 129.8	45	8	0	23.6 127.6	60	73	10	25.2 125.0	70	179	20	27.4 123.1	80	338	25
062018Z	22.4 129.0	45	22.4 129.0	50	0	5	23.0 126.1	65	79	15	24.5 123.5	75	161	25	26.3 121.2	80	265	30
062100Z	22.4 128.5	45	22.5 128.3	45	13	0	23.4 125.4	65	106	15	25.8 122.5	75	235	20	28.4 121.5	75	411	25
062106Z	22.4 128.1	45	22.5 128.0	45	8	0	22.9 125.7	55	57	5	24.7 122.8	65	156	10	26.8 120.9	70	375	20
062112Z	22.4 127.8	50	22.5 127.7	50	8	0	22.7 126.1	60	29	10	23.5 124.2	65	164	10	24.8 122.6	65	433	10
062118Z	22.3 127.3	50	22.5 127.3	50	12	0	22.7 125.7	60	49	10	23.7 123.8	65	203	15	25.1 122.2	65	475	5
062200Z	22.3 126.9	50	22.3 126.9	50	0	0	22.4 125.3	55	80	0	23.1 123.2	60	253	10	24.5 121.6	60	505	0
062206Z	22.3 126.5	50	22.3 126.5	50	0	0	22.5 124.9	55	108	0	23.3 122.9	60	337	10	24.8 121.3	60	547	5
062212Z	22.3 125.8	50	22.3 125.9	50	6	0	22.6 124.3	55	145	0	22.8 122.7	60	396	5	22.5 120.5	45	548	0
062218Z	22.2 125.0	50	22.3 125.1	50	8	0	22.5 122.5	60	106	10	22.5 120.0	45	305	-15	23.4 117.5	45	485	10
062300Z	22.1 123.9	55	22.2 124.1	50	13	-5	22.3 120.8	45	113	-5	22.9 117.4	35	255	-25	24.0 114.6	25	431	-5
062306Z	22.1 123.0	55	22.1 123.3	55	17	0	22.4 120.0	40	168	-10	23.1 116.8	35	280	-20	0.0 0.0	0	-0	0
062312Z	21.9 121.8	55	22.1 122.5	55	41	0	22.7 119.5	40	225	-15	23.4 116.2	30	326	-15	0.0 0.0	0	-0	0
062318Z	21.9 120.7	50	21.8 121.0	50	18	0	23.2 117.2	40	184	-20	0.0 0.0	0	-0	0	0.0 0.0	0	-0	0
062400Z	22.0 118.8	50	22.1 119.1	50	18	0	22.9 114.4	35	122	-25	0.0 0.0	0	-0	0	0.0 0.0	0	-0	0
062406Z	21.6 117.1	50	21.8 117.2	50	13	0	22.0 111.9	35	51	-20	0.0 0.0	0	-0	0	0.0 0.0	0	-0	0
062412Z	21.2 115.8	55	21.0 115.6	50	16	-5	20.1 110.2	40	89	-5	0.0 0.0	0	-0	0	0.0 0.0	0	-0	0
062418Z	21.2 114.7	60	21.1 114.6	50	8	-10	20.8 109.9	40	86	5	0.0 0.0	0	-0	0	0.0 0.0	0	-0	0
062500Z	21.2 113.2	60	21.2 113.4	55	11	-5	21.7 109.0	35	117	5	0.0 0.0	0	-0	0	0.0 0.0	0	-0	0
062506Z	21.2 112.2	55	21.2 112.3	55	6	0	0.0 0.0	0	-0	0	0.0 0.0	0	-0	0	0.0 0.0	0	-0	0
062512Z	21.5 110.7	45	21.3 110.7	50	12	5	0.0 0.0	0	-0	0	0.0 0.0	0	-0	0	0.0 0.0	0	-0	0
062518Z	21.9 108.9	35	21.8 109.0	45	8	10	0.0 0.0	0	-0	0	0.0 0.0	0	-0	0	0.0 0.0	0	-0	0
062600Z	22.3 107.0	30	22.4 107.0	30	6	0	0.0 0.0	0	-0	0	0.0 0.0	0	-0	0	0.0 0.0	0	-0	0

	ALL FORECASTS				TYPHOONS WHILE OVER 35 KTS			
	WRNG	24-HR	48-HR	72-HR	WRNG	24-HR	48-HR	72-HR
AVG FORECAST POSIT ERROR	14	93	224	389	0	0	0	0
AVG RIGHT ANGLE ERROR	10	44	114	224	0	0	0	0
AVG INTENSITY MAGNITUDE ERROR	2	9	14	13	0	0	0	0
AVG INTENSITY BIAS	0	1	6	12	0	0	0	0
NUMBER OF FORECASTS	28	24	18	16	0	0	0	0

DISTANCE TRAVELED BY TROPICAL CYCLONE IS 1609 NM

AVERAGE SPEED OF TROPICAL CYCLONE IS 9 KNOTS

TROPICAL STORM WYNNE
FIX POSITIONS FOR CYCLONE NO. 2

SATELLITE FIXES

	FIX NO.	TIME (Z)	FIX POSITION	ACCRY	DVORAK CODE	COMMENTS	SITE
	1	180000	20.0N 135.5E	PCN 6	T0.0/0.0	INIT OBS	PGTW
	2	180706	20.9N 135.3E	PCN 5			PGTW
	3	181200	20.6N 134.8E	PCN 6			PGTW
	4	181500	20.6N 134.1E	PCN 6			PGTW
	5	182136	20.6N 132.9E	PCN 6			PGTW
	6	190000	21.0N 132.8E	PCN 6			PGTW
	7	190136	20.9N 132.4E	PCN 5	T0.5/0.5 /D0.5/26HRS		PGTW
	8	190136	20.9N 133.1E	PCN 5	T0.5/0.5	INIT OBS	RPMK
	9	190300	20.8N 132.1E	PCN 6			PGTW
	10	190653	20.9N 132.3E	PCN 5			PGTW
	11	191016	20.7N 131.8E	PCN 6			PGTW
	12	191200	20.8N 131.5E	PCN 6			PGTW
	13	191416	20.8N 131.2E	PCN 6			PGTW
*	14	191500	20.8N 131.1E	PCN 6	T2.5/2.5 /D1.5/24HRS		PGTW
*	15	191800	21.0N 130.8E	PCN 6			PGTW
*	16	191938	21.1N 130.6E	PCN 5			PGTW
	17	192114	21.6N 131.2E	PCN 5			PGTW
	18	200115	21.5N 130.2E	PCN 5	T2.0/2.0 /D1.5/24HRS		RPMK
	19	200116	22.1N 130.8E	PCN 3	T2.5/2.5 /D2.0/24HRS		PGTW
	20	200300	22.4N 130.7E	PCN 6			PGTW
	21	200641	21.9N 130.2E	PCN 5			PGTW
	22	200641	22.1N 130.3E	PCN 5			RPMK
	23	200900	22.2N 129.8E	PCN 6			PGTW
	24	201200	22.4N 129.8E	PCN 6		ULCC FIX	PGTW
	25	201356	22.2N 129.2E	PCN 3			RODN
	26	201800	22.3N 128.9E	PCN 4	T3.0/3.0 /D0.5/27HRS		PGTW
	27	201925	22.5N 129.3E	PCN 5			RPMK
	28	202053	22.3N 128.7E	PCN 3	T2.5/2.5	INIT OBS	RODN
	29	202100	22.5N 128.6E	PCN 6			PGTW
	30	210000	22.1N 128.2E	PCN 6		ULCC FIX	PGTW
	31	210055	22.5N 128.1E	PCN 3	T3.0/3.0 /D1.0/24HRS		RPMK
	32	210300	22.6N 128.2E	PCN 4	T3.0/3.0-/D0.5/23HRS		PGTW
	33	210600	22.7N 127.8E	PCN 4			PGTW
	34	210628	22.4N 127.9E	PCN 3			RPMK
	35	210628	22.3N 128.1E	PCN 3			RODN
	36	210900	22.6N 127.8E	PCN 6			PGTW
	37	210933	22.3N 127.7E	PCN 4			RPMK
	38	211200	22.4N 127.6E	PCN 6			PGTW
	39	211335	22.4N 127.6E	PCN 6		ULCC FIX	PGTW
	40	211500	22.3N 127.5E	PCN 6	T3.0/3.0 /S0.0/21HRS	ULCC FIX	PGTW
	41	211800	22.4N 127.2E	PCN 6		ULCC FIX	PGTW
	42	212100	22.2N 126.9E	PCN 6		ULCC FIX	PGTW
	43	212213	22.3N 127.2E	PCN 6	T3.0/3.0 /S0.0/22HRS		RPMK
	44	212221	22.2N 126.4E	PCN 3	T2.5/2.5 /S0.0/24HRS		RODN
	45	220000	22.5N 126.8E	PCN 6			PGTW
	46	220035	22.4N 126.5E	PCN 3	T3.0/3.0 /S0.0/22HRS		PGTW
	47	220035	22.4N 126.8E	PCN 5			RODN
*	48	220217	22.9N 126.2E	PCN 3	T3.5/3.5	INIT OBS	RSKO
	49	220300	22.6N 126.6E	PCN 6			PGTW
	50	220600	22.2N 126.2E	PCN 6		ULCC FIX	PGTW
	51	220615	22.3N 126.2E	PCN 3			PGTW
	52	220616	22.2N 126.2E	PCN 5			RPMK
	53	220900	22.2N 126.0E	PCN 6		ULCC FIX	PGTW
	54	221053	22.4N 126.1E	PCN 5			RODN
	55	221200	22.0N 125.7E	PCN 6			PGTW
	56	221457	22.0N 125.2E	PCN 6			RPMK
	57	221600	22.0N 125.0E	PCN 6	T3.5/3.5 /D0.5/24HRS		PGTW
	58	221800	22.0N 124.6E	PCN 6			PGTW
	59	221900	21.9N 124.3E	PCN 6			PGTW
	60	222152	22.1N 124.0E	PCN 5	T3.0/3.0 /S0.0/24HRS		RPMK
	61	230000	22.0N 124.0E	PCN 6			PGTW
	62	230156	21.8N 124.0E	PCN 5	T3.0/3.0	INIT OBS	RODN
	63	230300	22.2N 123.7E	PCN 6	T3.5/3.5-/D0.5/27HRS		PGTW
	64	230600	22.2N 123.1E	PCN 6			PGTW
	65	230900	21.7N 122.8E	PCN 6		ULCC FIX	PGTW
	66	231032	22.0N 122.8E	PCN 5	T3.5/3.5-	INIT OBS	RSKO
	67	231200	21.7N 121.7E	PCN 6			PGTW
	68	231437	21.9N 121.4E	PCN 6			RPMK
	69	231800	21.8N 120.7E	PCN 6	T3.5/3.5-/S0.0/26HRS		PGTW
	70	232100	22.0N 119.6E	PCN 6			PGTW
	71	232330	22.3N 119.8E	PCN 6			RODN
	72	240000	22.0N 118.8E	PCN 6			PGTW
	73	240136	21.9N 118.3E	PCN 5			PGTW
*	74	240136	21.0N 117.5E	PCN 5	T3.0/3.0 /S0.0/27HRS		RPMK
	75	240300	21.6N 117.8E	PCN 6	T3.0/3.5-/W0.5/24HRS		PGTW

76	240600	21.6N 117.2E	PCN 6				PGTW
77	240733	22.0N 116.2E	PCN 5	T3.0/3.0		INIT OBS	RODN
78	240900	21.7N 116.2E	PCN 6				PGTW
79	241011	21.8N 115.9E	PCN 6				PGTW
80	241011	22.0N 116.1E	PCN 5	T3.5/3.5-/S0.0/24HRS			RSKO
81	241200	21.2N 115.6E	PCN 6				PGTW
82	241417	21.3N 114.3E	PCN 6	T3.0/3.0 /S0.0/24HRS			RPMK
83	241800	21.3N 115.0E	PCN 6	T2.5/3.5 /W1.0/24HRS	ULCC FIX		PGTW
84	242017	21.2N 113.5E	PCN 6				RODN
85	242100	21.3N 114.5E	PCN 6		ULCC FIX		PGTW
86	242251	20.5N 113.5E	PCN 6				RODN
87	242251	21.1N 113.5E	PCN 4	T3.0/3.0-/S0.0/21HRS			RPMK
88	250000	21.2N 113.4E	PCN 6				PGTW
89	250257	21.1N 112.9E	PCN 3	T3.0/3.0-/S0.0/24HRS			RPMK
90	250300	21.0N 112.7E	PCN 4	T3.5/3.5-/D0.5/24HRS			PGTW
91	250600	21.2N 112.2E	PCN 4				PGTW
92	250720	21.8N 111.8E	PCN 5	T3.5/3.5 /D0.5/24HRS			RODN
93	250900	21.1N 111.5E	PCN 4				PGTW
94	251131	21.7N 110.4E	PCN 5				RODN
95	251200	21.4N 110.7E	PCN 4				PGTW
96	251500	21.6N 109.8E	PCN 4				PGTW
97	251800	21.9N 108.9E	PCN 6		ULCC FIX		PGTW
98	252005	21.9N 107.6E	PCN 5				RODN
99	252100	22.3N 108.2E	PCN 6		ULCC FIX		PGTW
100	252230	21.9N 107.1E	PCN 5				RODN
101	260000	21.6N 106.6E	PCN 6				PGTW
102	260300	22.1N 105.1E	PCN 6				PGTW
103	260600	21.5N 103.8E	PCN 6				PGTW

AIRCRAFT FIXES

FIX NO.	TIME (Z)	FIX POSITION	FLT LVL	700MB HGT	OBS MSLP	MAX-SFC-WND VEL/BRG/RNG	MAX-FLT-LVL-WND DIR/VEL/BRG/RNG	ACCRY NAV/MET	EYE SHAPE	EYE ORIEN- DIAM/TATION	EYE TEMP (C) OUT/ IN/ DP/SST	MSN NO.
1	182337	20.8N 133.6E	1500FT		998	20 190 30	220 27 190 30	6 3			+25 +26 +23 29	1
2	190542	21.3N 132.9E	1500FT		1001	35 040 24	240 33 120 60	7 10			+26 +25 +24	2
3	190831	21.6N 132.7E	1500FT		1000	10 310 30	360 18 250 10	5 10			+25 +26 +26 28	2
4	192031	21.9N 131.4E	700MB	3042	995	30 270 20	140 29 030 30	11 5				3
5	192325	22.2N 131.2E	1500FT		992	35 090 15	200 35 090 15	12 3			+26 +27 +27	3
6	200533	22.2N 130.6E	1500FT		989	45 120 10	240 43 120 13	10 2				4
7	200819	22.4N 130.2E	1500FT		990	35 230 45	130 45 030 30	10 3			+26 29	4
8	202033	22.2N 128.5E	700MB	3050		35 280 20	320 31 290 58	8 10			+10 +11 +10	5
9	202328	22.7N 128.5E	1500FT		992	40 240 26	350 44 240 25	5 3			+25 +26 +25 28	5
10	210530	22.6N 128.2E	1500FT		996	45 050 25	120 44 020 26	9 4			+24 +27 +27 29	6
11	210812	22.4N 128.1E	1500FT		998	50 140 45	170 50 120 42	4 2			+24 +27 +27 30	6
12	211212	22.3N 127.7E	700MB	2983			060 56 030 30	12 15				7
13	211437	22.3N 127.5E	700MB	2983	986		220 42 140 32	8 5			+11 +16 +12	7
14	212054	22.2N 127.2E	700MB	2972	985	40 300 30	050 38 300 24	10 5			+12 +16 +11	8
15	212322	22.3N 126.8E	1500FT		986	50 050 25	150 50 060 38	7 2			+25 +26 +24 31	8
16	220535	22.4N 126.6E	1500FT		986	45 060 25	140 47 060 28	9 3			+24 +25 +25 30	9
17	220835	22.3N 126.3E	1500FT		986	40 190 25	240 45 190 35	5 3			+24 +25 +26 30	9
18	221159	22.2N 125.8E	700MB	2980			120 51 040 31	5 4				10
19	221435	22.3N 125.4E	700MB	2980	988		240 44 190 70	10 4			+12 +15 +15	10
20	222042	22.1N 124.6E	700MB	2975		25 220 30	160 38 060 60	13 10				11
21	222333	22.3N 124.2E	1500FT		985	50 130 45	210 60 130 45	8 10	ELLIPTICAL	20 10 180	+25 +26 +24 28	11
22	230543	22.0N 123.4E	1500FT		982	55 310 30	030 50 310 30	10 3				12
23	230824	21.9N 123.0E	1500FT		982	55 090 6	190 55 090 6	10 3			+24 +27 +26 30	12

RADAR FIXES

FIX NO.	TIME (Z)	FIX POSITION	RADAR	ACCRY	EYE SHAPE	EYE DIAM	RADOB-CODE ASWAR TDDFF	COMMENTS	RADAR POSITION	SITE WMO NO
* 1	220300	22.1N 126.0E	LAND				35//2 5////		24.8N 125.3E	47927
* 2	220400	22.1N 126.0E	LAND				6///3 50000		24.8N 125.3E	47927
3	221200	22.2N 125.7E	LAND				52912 73009		24.3N 124.2E	47918
4	221500	22.4N 125.4E	LAND				6//12 72905		24.3N 124.2E	47918
5	221600	22.5N 125.2E	LAND				6//12 53011		24.3N 124.2E	47918
6	221900	22.1N 124.5E	LAND				5//13 72415		24.3N 124.2E	47918
7	222000	21.9N 124.4E	LAND				6//13 72212		24.3N 124.2E	47918
8	222100	22.2N 124.3E	LAND				6//12 72808		24.3N 124.2E	47918
9	222200	21.9N 124.0E	LAND				6//12 72509		24.3N 124.2E	47918
10	222300	21.9N 124.2E	LAND				6//13 72804		24.3N 124.2E	47918
11	230000	21.8N 124.1E	LAND				6//12 72107		24.3N 124.2E	47918
12	230100	21.8N 123.9E	LAND				6//12 72202		24.3N 124.2E	47918
13	230200	21.9N 123.7E	LAND				6///2 72810		24.3N 124.2E	47918
14	230300	21.9N 123.4E	LAND				6///2 72812		24.3N 124.2E	47918
15	230400	21.9N 123.1E	LAND				5//12 72816		24.3N 124.2E	47918
16	230500	21.8N 123.0E	LAND				3//12 72614		24.3N 124.2E	47918
17	240720	21.4N 116.9E	LAND				20510 /////		22.3N 114.2E	45005
18	241100	21.2N 116.3E	LAND				20814 32508		22.3N 114.2E	45005
19	241200	21.1N 116.0E	LAND				20811 72406		22.3N 114.2E	45006
20	241300	21.2N 115.9E	LAND				20911 72708		22.3N 114.2E	45005
21	241700	21.2N 115.0E	LAND				20971 72616		22.3N 114.2E	45005
22	241800	21.2N 114.8E	LAND				20941 32615		22.3N 114.2E	45005
23	241900	21.1N 114.5E	LAND				20911 72714		22.3N 114.2E	45005
24	242000	21.2N 114.4E	LAND				20971 32811		22.3N 114.2E	45005
25	242100	21.3N 114.2E	LAND				20911 72810		22.3N 114.2E	45005
26	242200	21.2N 113.8E	LAND				20911 72812		22.3N 114.2E	45005
27	242310	21.1N 113.5E	LAND				20911 72612		22.3N 114.2E	46005
28	250000	21.1N 113.4E	LAND				20911 62612		22.3N 114.2E	45005
29	250100	21.1N 113.1E	LAND				20911 72614		22.3N 114.2E	45005
30	250210	21.2N 112.9E	LAND				20911 32710		22.3N 114.2E	45005
31	250300	21.2N 112.7E	LAND				20941 72713		22.3N 114.2E	45005
32	250350	21.2N 112.5E	LAND				20912 72913		22.3N 114.2E	45005
33	250500	21.2N 112.4E	LAND				60941 72809		22.3N 114.2E	45005
34	250600	21.3N 112.3E	LAND				60942 72712		22.3N 114.2E	45005
35	250700	21.4N 112.0E	LAND				60912 32810		22.3N 114.2E	45005
36	251000	21.4N 111.3E	LAND				60912 62812		22.3N 114.2E	45006
37	251100	21.4N 111.1E	LAND				60/// 72812		22.3N 114.2E	45005

SYNOPTIC FIXES

FIX NO.	TIME (Z)	FIX POSITION	INTENSITY ESTIMATE	NEAREST DATA (NM)	COMMENTS
1	231200	21.8N 121.7E	055	015	RCVD AFTER WARNING TIME, NOT USED IN WARNING.4672
2	231500	21.9N 121.3E	055	018	STN 46762 22.02N 121.33E
3	240900	21.0N 116.6E	055	025	STN RCLM 59810 16.50N 118.20E

NOTICE - THE ASTERISKS (*) INDICATE FIXES UNREPRESENTATIVE AND NOT USED FOR BEST TRACK PURPOSES.

TYPHOON ALEX
BEST TRACK DATA

	BEST TRACK		WARNING		ERRORS		24 HOUR FORECAST		ERRORS		48 HOUR FORECAST		ERRORS		72 HOUR FORECAST		ERRORS	
MO/DA/HR	POSIT	WIND	POSIT	WIND	DST	WIND	POSIT	WIND	DST	WIND	POSIT	WIND	DST	WIND	POSIT	WIND	DST	WIND
070100Z	16.1 124.5	30	16.1 124.6	25.	6	-5.	15.9 121.3	30.	157	-15.	16.2 118.8	35.	366.	-35.	16.9 116.4	50.	706.	-10
070106Z	16.1 124.2	30	16.1 123.6	30	35.	0	16.0 120.5	30.	204.	-25	16.4 118.1	40.	456.	-35.	17.2 115.8	50.	814.	0
070112Z	16.3 124.0	35	16.0 122.8	30.	71	-5.	16.2 119.2	30.	286.	-30.	16.8 116.8	40	529.	-25	17.7 114.6	50.	914.	5
070118Z	16.8 123.8	40	16.0 122.5	40.	89.	0.	16.0 119.4	30.	319.	-35	16.7 117.1	40.	603	-25.	17.6 114.8	50	1033.	10
070200Z	17.3 123.6	45	16.9 122.8	40	52.	-5.	18.5 121.5	30	192.	-40	19.8 120.0	35.	484.	-25.	21.4 118.7	50.	828.	15
070206Z	18.1 123.3	55	18.2 123.2	55.	8	0.	21.6 121.2	75.	103.	0.	25.2 119.4	60.	293.	10	29.2 119.9	40.	525.	10
070212Z	19.3 123.0	60	19.1 123.1	60.	13	0.	22.8 121.8	75.	122.	10	26.9 122.5	70.	252	25.	0.0	0.0	0.	-0.	0.
070218Z	20.6 122.2	65	20.3 122.7	65.	33.	0.	24.6 122.1	70.	111.	5	29.1 123.7	65	222.	25.	0.0	0.0	0.	-0.	0
070300Z	21.7 121.6	70	21.8 121.6	80.	6.	10	27.6 122.6	70.	75.	10.	31.6 125.5	65.	145.	30.	0.0	0.0	0.	-0.	0
070306Z	23.3 121.5	75	23.3 121.5	80	0	5	29.0 123.3	70.	86.	20.	32.8 127.2	60	156.	30	0.0	0.0	0.	-0.	0.
070312Z	24.7 121.0	65	24.6 121.5	75	28	10.	28.7 122.0	65.	147.	20.	0.0 0.0	0.	-0.	0	0.0	0.0	0.	-0.	0.
070318Z	26.1 120.9	65	25.8 121.2	70.	24.	5.	29.9 122.6	60.	185.	20.	0.0 0.0	0	-0	0	0.0	0.0	0.	-0	0.
070400Z	27.8 121.2	60	27.0 121.3	55	48.	-5.	32.3 123.4	45.	133.	10	0.0 0.0	0	-0	0.	0.0	0.0	0.	-0.	0.
070406Z	29.6 121.8	50	29.4 121.5	45.	20.	-5	34.9 126.4	35.	49.	5	0.0 0.0	0	-0.	0.	0.0	0.0	0.	-0.	0
070412Z	31.1 122.6	45	31.2 122.4	45	12.	0	0.0 0.0	0.	-0.	0	0.0 0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
070418Z	32.8 123.8	40	32.8 123.4	40.	20	0.	0.0 0.0	0.	-0	0	0.0 0.0	0	-0.	0	0.0	0.0	0.	-0.	0
070500Z	34.0 125.1	35	34.1 125.2	35	8.	0.	0.0 0.0	0.	-0.	0.	0.0 0.0	0	-0.	0	0.0	0.0	0.	-0.	0
070506Z	35.4 127.2	30	35.4 127.1	35	5.	5	0.0 0.0	0.	-0.	0.	0.0 0.0	0	-0.	0	0.0	0.0	0.	-0	0

	ALL FORECASTS				TYPHOONS WHILE OVER 35 KTS			
	WRNG	24-HR	48-HR	72-HR	WRNG	24-HR	48-HR	72-HR
AVG FORECAST POSIT ERROR	27.	155.	351.	803.	29.	163.	372.	859.
AVG RIGHT ANGLE ERROR	23.	93.	197	328.	24.	99.	205.	376.
AVG INTENSITY MAGNITUDE ERROR	3	18.	27.	8.	3.	18	26	8.
AVG INTENSITY BIAS	1.	-3.	-3	5.	1.	-4	-6.	4
NUMBER OF FORECASTS	18	14	10	6	15	13	9	5

DISTANCE TRAVELED BY TROPICAL CYCLONE IS 1320. NM

AVERAGE SPEED OF TROPICAL CYCLONE IS 13 KNOTS

TYPHOON ALEX
FIX POSITIONS FOR CYCLONE NO. 3

SATELLITE FIXES

FIX NO.	TIME (Z)	FIX POSITION	ACCRY	DVORAK CODE	COMMENTS	SITE
1	292105	18.7N 127.7E	PCN 3	T1.0/1.0	INIT OBS	PGTW
2	292301	19.0N 127.6E	PCN 3		EXP LLCC	PGTW
3	300600	16.1N 126.8E	PCN 6		ULCC FIX	PGTW
4	010056	16.2N 124.3E	PCN 5	T2.0/2.0-	INIT OBS	PGTW
5	010056	16.1N 124.2E	PCN 3	T2.5/2.5-	INIT OBS	RPMK
6	010600	16.2N 123.5E	PCN 6			PGTW
7	011100	15.7N 123.2E	PCN 6			PGTW
* 8	011115	14.8N 123.3E	PCN 6			RPMK
* 9	011337	15.4N 123.2E	PCN 6		ULCC FIX	PGTW
10	011700	15.7N 123.3E	PCN 6	T3.0/3.0-	INIT OBS	PGTW
11	012204	16.8N 123.1E	PCN 4		EXP LLCC	PGTW
12	012300	17.2N 123.1E	PCN 6	T3.0/3.0-/D1.0/23HRS		PGTW
13	012354	17.0N 123.0E	PCN 5	T3.0/3.0 /D0.5/23HRS		RPMK
14	012354	17.1N 123.1E	PCN 5	T3.0/3.0	INIT OBS	RODN
15	020217	17.2N 123.1E	PCN 5			RPMK
16	020217	18.0N 123.6E	PCN 5			RODN
17	020600	17.9N 123.3E	PCN 4			PGTW
18	021044	18.9N 123.2E	PCN 4			RODN
19	021050	18.9N 123.3E	PCN 6		ULCC FIX	PGTW
20	021200	18.5N 123.1E	PCN 6		ULCC FIX	PGTW
21	021800	20.0N 122.0E	PCN 6	T3.5/3.5-/D0.5/25HRS		PGTW
22	022142	21.4N 121.4E	PCN 2			PGTW
23	022329	21.5N 121.6E	PCN 1	T4.0/4.0 /D1.0/24HRS		RPMK
24	022329	21.7N 121.6E	PCN 1	T4.0/4.0 /D1.0/24HRS		PGTW
25	030157	22.4N 121.7E	PCN 1	T4.5/4.5 /D1.5/26HRS	12NM EYE	RPMK
26	030157	22.3N 121.6E	PCN 3			PGTW
27	030722	23.5N 121.4E	PCN 5			PGTW
28	031026	24.4N 120.9E	PCN 5		ULCC FIX	PGTW
29	031438	25.1N 120.7E	PCN 5		ULCC FIX	RPMK
30	032007	25.7N 120.5E	PCN 6			RODN
31	032121	26.6N 121.1E	PCN 6			PGTW
32	032305	27.6N 121.6E	PCN 5	T2.0/3.0-/W2.0/24HRS		PGTW
33	032305	26.8N 120.6E	PCN 5			RPMK
34	040137	28.8N 121.7E	PCN 3	T3.0/4.0 /W1.5/24HRS		RPMK
35	040137	28.7N 120.7E	PCN 3	T2.0/2.0	INIT OBS	RODN
36	040709	29.8N 122.2E	PCN 3		EXP LLCC	RPMK
37	041001	30.1N 122.4E	PCN 5			PGTW
38	041954	32.9N 124.8E	PCN 3			RPMK
39	050117	34.2N 125.3E	PCN 3	T2.0/3.0 /W1.0/24HRS		RPMK
40	051200	36.8N 131.7E	PCN 6			PGTW

AIRCRAFT FIXES

FIX NO.	TIME (Z)	FIX POSITION	FLT LVL	700MB HGT	OBS MSLP	MAX-SFC-WND VEL/BRG/RNG	MAX-FLT-LVL-WND DIR/VEL/BRG/RNG	ACCRY NAV/MET	EYE SHAPE	EYE ORIEN- DIAM/TATION	EYE TEMP (C) OUT/ IN/ DP/SST	MSN NO.
1	302327	16.1N 124.6E	1500FT		1000	30 100 60	110 35 090 30	10 5			+26 +24 +23	1
2	020351	17.7N 123.5E	700MB	2964		65 040 15	140 68 030 25	15 5			+ 9 +11 +11	2
3	020549	18.0N 123.3E	700MB	2952	984	65 180 10	060 38 340 38	18 5	ELLIPTICAL	30 20 030	+10 +13 + 9	2
4	022045	21.2N 121.5E	700MB	2772		55 090 30	180 92 100 16	12 3	CIRCULAR	15		3
5	022337	21.6N 121.6E	700MB	2779	962	80 050 10	120 69 030 20	13 1	CIRCULAR	12	+10 +16 +16	3

RADAR FIXES

FIX NO	TIME (Z)	FIX POSITION	RADAR	ACCRY	EYE SHAPE	EYE DIAM	RADOB-CODE ASWAR TDDFF	COMMENTS	RADAR POSITION	SITE WMO NO.
1	011900	16.6N 123.9E	LAND				11320 63515	EYE 100 PCT ELIP	15.7N 121.6E	98333
2	020330	17.6N 123.5E	LAND				10301 ////		18.4N 121.6E	98231
3	020600	18.1N 123.4E	LAND				10991 60406		18.4N 121.6E	98231
4	020800	18.6N 123.2E	LAND				10971 63430		18.4N 121.6E	98231
5	020900	18.7N 123.2E	LAND				11922 43506		18.4N 121.6E	98231
6	021600	20.5N 122.4E	LAND				10612 43510	EYE 80 PCT CIR OPN N	18.4N 121.6E	98231
7	021600	20.3N 122.3E	LAND				35350 53230		20.4N 121.8E	98136
8	021700	20.4N 122.3E	LAND				35/50 53230	EYE ILL DEFINED	20.4N 121.8E	98136
9	021730	20.7N 122.3E	LAND				10552 43320	EYE 60 PCT CIR OPN N	18.4N 121.6E	98231
10	021800	20.8N 122.2E	LAND				10512 43418	EYE 60 PCT CIR OPN N	18.4N 121.6E	98231
11	021800	20.6N 122.2E	LAND				35/50 53231	EYE ILL DEFINED	20.4N 121.8E	98136
12	022000	21.8N 121.8E	LAND				6//// 53510		22.0N 120.7E	46752
13	022100	21.3N 121.6E	LAND				6//// 53018		22.6N 120.3E	46744
14	022100	21.3N 121.7E	LAND				6//// 53610		22.0N 120.7E	46752
15	022200	21.5N 121.6E	LAND				45/// 53610		22.5N 120.5E	59553
16	030100	22.1N 121.6E	LAND				5//44 43516		24.3N 124.2E	47918
17	030100	22.0N 121.6E	LAND				255// 53616		22.6N 120.3E	46744
18	030100	21.8N 121.7E	LAND				6//// 53608		22.0N 120.7E	46752
19	030100	22.0N 121.8E	LAND				10332 50119		23.8N 121.6E	46699
20	030200	22.4N 121.6E	LAND				11714 53616		24.3N 124.2E	47918
21	030300	22.5N 121.5E	LAND				11713 53511		24.3N 124.2E	47918
22	030300	22.5N 121.5E	LAND				25/// 53411		22.6N 120.3E	46744
23	030300	22.5N 121.6E	LAND				10222 53518		23.8N 121.6E	46699
24	030300	22.6N 121.6E	LAND				6//// 53614		22.0N 120.7E	46752

25	030400	22.7N 121.6E	LAND	12212 53612	23 8N 121.6E	46699
26	030400	22 9N 121.5E	LAND	22413 73615	24 3N 124.2E	47918
27	030400	22.8N 121.5E	LAND	6//// 53614	22.0N 120.7E	46752
28	030500	23.2N 121.6E	LAND	4/533 53615	23.8N 121.6E	46699
29	030500	23 0N 121.4E	LAND	645// 53514	22.6N 120.3E	46744
30	030500	23 2N 121.5E	LAND	6//// 53614	22 0N 120.7E	46752
31	030500	23 1N 121.5E	LAND	25/13 73615	24.3N 124.2E	47918
32	030600	23.3N 121 4E	LAND	65/13 73516	24.3N 124.2E	47918
33	030700	23.5N 121.5E	LAND	35/13 73612	24.3N 124.2E	47918
34	030800	23.8N 121.5E	LAND	65//3 73615	24.3N 124.2E	47918

SYNOPTIC FIXES

FIX NO.	TIME (Z)	FIX POSITION	INTENSITY ESTIMATE	NEAREST DATA (NM)	COMMENTS
1	040600	29.4N 121.6E	045	035	58556 58562 58569
2	040900	29.8N 122 0E	045	030	58562 58474 58569
3	041200	31.3N 122 9E	045	030	58472 58477 58367

NOTICE - THE ASTERISKS (*) INDICATE FIXES UNREPRESENTATIVE AND NOT USED FOR BEST TRACK PURPOSES.

TROPICAL STORM BETTY BEST TRACK DATA

MO/DA/HR	BEST TRACK POSIT	BEST TRACK WIND	WARNING POSIT	WARNING WIND	WARNING ERRORS DST	WARNING ERRORS WIND	24 HOUR FORECAST POSIT	24 HR WIND	24 HR ERRORS DST	24 HR ERRORS WIND	48 HOUR FORECAST POSIT	48 HR WIND	48 HR ERRORS DST	48 HR ERRORS WIND	72 HOUR FORECAST POSIT	72 HR WIND	72 HR ERRORS DST	72 HR ERRORS WIND
070418Z	14.7 126.3	25	0.0 0.0	0.	-0.	0.	0.0 0.0	0.	-0.	0.	0.0 0.0	0.	-0.	0.	0.0 0.0	0.	-0.	0.
070500Z	14.5 125.0	25	0.0 0.0	0.	-0.	0.	0.0 0.0	0.	-0.	0.	0.0 0.0	0.	-0.	0.	0.0 0.0	0.	-0.	0.
070506Z	14.6 123.8	25	0.0 0.0	0.	-0.	0.	0.0 0.0	0.	-0.	0.	0.0 0.0	0.	-0.	0.	0.0 0.0	0.	-0.	0.
070512Z	14.8 122.8	25	0.0 0.0	0.	-0.	0.	0.0 0.0	0.	-0.	0.	0.0 0.0	0.	-0.	0.	0.0 0.0	0.	-0.	0.
070518Z	15.1 121.8	25	0.0 0.0	0.	-0.	0.	0.0 0.0	0.	-0.	0.	0.0 0.0	0.	-0.	0.	0.0 0.0	0.	-0.	0.
070600Z	15.5 120.9	20	0.0 0.0	0.	-0.	0.	0.0 0.0	0.	-0.	0.	0.0 0.0	0.	-0.	0.	0.0 0.0	0.	-0.	0.
070606Z	15.9 120.2	20	0.0 0.0	0.	-0.	0.	0.0 0.0	0.	-0.	0.	0.0 0.0	0.	-0.	0.	0.0 0.0	0.	-0.	0.
070612Z	16.3 119.4	25	16.4 119.0	25.	24.	0.	18.3 115.6	40.	58.	5.	20.6 112.1	50.	111.	0.	23.1 109.8	30.	42.	-5.
070618Z	16.8 118.6	25	17.2 118.3	30.	30.	5.	19.3 115.1	45.	75.	5.	21.8 111.8	60.	98.	5.	24.4 109.8	30.	125.	5.
070700Z	17.2 117.9	30	17.4 117.8	30.	13.	0.	19.4 115.3	50.	33.	5.	21.9 112.4	60.	36.	5.	0.0 0.0	0.	-0.	0.
070706Z	17.6 117.3	30	17.5 117.2	30.	8.	0.	19.1 115.0	45.	30.	-5.	21.6 112.9	55.	109.	5.	0.0 0.0	0.	-0.	0.
070712Z	18.1 116.6	35	18.0 116.5	30.	8.	-5.	20.0 114.5	45.	29.	-5.	23.2 112.7	30.	173.	-5.	0.0 0.0	0.	-0.	0.
070718Z	18.6 116.2	40	18.5 115.9	30.	18.	-10.	20.8 113.9	45.	45.	-10.	0.0 0.0	0.	-0.	0.	0.0 0.0	0.	-0.	0.
070800Z	19.0 115.7	45	19.0 115.5	45.	11.	0.	21.3 113.6	55.	73.	0.	0.0 0.0	0.	-0.	0.	0.0 0.0	0.	-0.	0.
070806Z	19.6 115.0	50	19.8 115.0	50.	12.	0.	22.5 112.8	50.	104.	0.	0.0 0.0	0.	-0.	0.	0.0 0.0	0.	-0.	0.
070812Z	20.1 114.0	50	20.2 114.1	50.	8.	0.	23.2 111.9	40.	131.	5.	0.0 0.0	0.	-0.	0.	0.0 0.0	0.	-0.	0.
070818Z	20.7 113.1	55	20.8 113.2	55.	8.	0.	23.6 110.9	25.	143.	0.	0.0 0.0	0.	-0.	0.	0.0 0.0	0.	-0.	0.
070900Z	21.3 112.3	55	21.3 112.2	55.	6.	0.	0.0 0.0	0.	-0.	0.	0.0 0.0	0.	-0.	0.	0.0 0.0	0.	-0.	0.
070906Z	22.0 111.0	50	22.1 111.0	50.	6.	0.	0.0 0.0	0.	-0.	0.	0.0 0.0	0.	-0.	0.	0.0 0.0	0.	-0.	0.
070912Z	22.4 109.7	35	0.0 0.0	0.	-0.	0.	0.0 0.0	0.	-0.	0.	0.0 0.0	0.	-0.	0.	0.0 0.0	0.	-0.	0.
070918Z	22.7 108.5	25	0.0 0.0	0.	-0.	0.	0.0 0.0	0.	-0.	0.	0.0 0.0	0.	-0.	0.	0.0 0.0	0.	-0.	0.

	ALL FORECASTS WRNG	24-HR	48-HR	72-HR	TYPHOONS WHILE OVER 35 KTS WRNG	24-HR	48-HR	72-HR
AVG FORECAST POSIT ERROR	13	72	105	83.	0.	0.	0.	0.
AVG RIGHT ANGLE ERROR	9	42	46	80.	0.	0.	0.	0.
AVG INTENSITY MAGNITUDE ERROR	2	4	4	5.	0.	0.	0.	0.
AVG INTENSITY BIAS	-1	0.	2	0.	0.	0.	0.	0.
NUMBER OF FORECASTS	12	10	5	2	0	0	0	0

DISTANCE TRAVELED BY TROPICAL CYCLONE IS 1157. NM

AVERAGE SPEED OF TROPICAL CYCLONE IS 10 KNOTS

TROPICAL STORM BETTY
FIX POSITIONS FOR CYCLONE NO. 4

SATELLITE FIXES

FIX NO.	TIME (Z)	FIX POSITION	ACCRY	DVORAK CODE	COMMENTS	SITE
1	012023	18.8N 146.4E	PCN 5	T0 0/0.0	INIT OBS	PGTW
2	020902	16.1N 140.5E	PCN 5			PGTW
3	021800	11.8N 136.4E	PCN 6		ULCC FIX	PGTW
4	031027	9.8N 131.0E	PCN 5	T1 0/1.0	INIT OBS	PGTW
5	032121	9.6N 130.0E	PCN 6			PGTW
6	032305	14.6N 128.0E	PCN 5	T1.5/1.5	INIT OBS	PGTW
7	040137	15.0N 128.0E	PCN 5	T1.5/1.5	INIT OBS	RPMK
8	040709	14.6N 127.1E	PCN 5			PGTW
9	040709	16.1N 128.0E	PCN 5			RPMK
10	041001	15.5N 127.5E	PCN 5			PGTW
11	041200	15.2N 127.7E	PCN 6			PGTW
12	041417	14.8N 127.4E	PCN 6			PGTW
13	041800	15.1N 127.1E	PCN 6	T0.5/0.5	INIT OBS	PGTW
14	042241	15.1N 126.4E	PCN 5			PGTW
15	050117	14.0N 123.8E	PCN 3	T1.0/1.0-	INIT OBS	PGTW
16	050117	14.7N 125.0E	PCN 5	T1.5/1.5 /S0.0/24HRS		RPMK
17	050657	14.4N 123.8E	PCN 5			PGTW
18	051119	14.7N 123.4E	PCN 6			RPMK
19	051200	14.9N 123.2E	PCN 6			PGTW
20	051357	15.2N 122.0E	PCN 6			PGTW
21	051800	15.2N 122.0E	PCN 6	T1 0/1.0+/D0.5/24HRS		PGTW
22	051942	15.3N 121.4E	PCN 6			PGTW
23	052220	15.4N 121.4E	PCN 5	T2.0/2.0	INIT OBS	RODN
24	052358	15.3N 120.6E	PCN 5	T1 5/1.5+/S0.0/23HRS		RPMK
25	060000	15.6N 120.8E	PCN 6			PGTW
26	060644	15.8N 119.7E	PCN 5			PGTW
27	061055	16.5N 119.4E	PCN 6		ULCC FIX	PGTW
28	061200	17.1N 119.6E	PCN 6			PGTW
29	061800	17.6N 118.5E	PCN 6			PGTW
30	061929	17.0N 117.9E	PCN 5	T2.5/2.5 /D1.5/24HRS		PGTW
31	062333	17.5N 118.2E	PCN 5			PGTW
32	062335	17.3N 118.1E	PCN 3	T2.0/2.0 /S0 0/25HRS	EXP LLCC	RODN
33	070218	17.7N 118.2E	PCN 5	T1 5/1.5+/S0 0/26HRS		RPMK
34	070600	17.4N 116.8E	PCN 6	T2 0/2.0	INIT OBS ULCC FIX	PGTW
35	070814	17.9N 116.3E	PCN 5	T2.0/2.0+/D0 5/32HRS		RPMK
36	071030	17.7N 116.5E	PCN 6			PGTW
37	071200	18.0N 116.6E	PCN 6			PGTW
38	071458	18.4N 115.3E	PCN 5			RODN
39	071800	18.3N 115.7E	PCN 6	T2.0/2.5+/W0.5/23HRS		PGTW
40	072059	18.3N 115.0E	PCN 6	T2 0/2 0 /D0 5/26HRS		RPMK
41	072138	18.5N 115.3E	PCN 5			PGTW
42	072249	19.1N 115.9E	PCN 6	T3.0/3.0 /D1 0/24HRS		RODN
43	072309	18.5N 115.2E	PCN 5			PGTW
44	080000	18.6N 115.3E	PCN 6		ULCC FIX	PGTW
45	080157	19.6N 115.3E	PCN 5	T3.0/3.0 /D1.0/20HRS		PGTW
46	080600	20.0N 114.7E	PCN 6			PGTW
47	080801	20.0N 114.7E	PCN 4	T3 0		RPMK
48	081017	20.4N 114.2E	PCN 6		ULCC FIX	PGTW
49	081147	20.3N 114.0E	PCN 4			RODN
50	081148	20.1N 114.1E	PCN 6			RPMK
51	081200	20.1N 113.9E	PCN 6		ULCC FIX	PGTW
52	081438	20.6N 113.1E	PCN 3			RPMK
53	081800	20.5N 112.7E	PCN 6	T3.0/3.0-/D1.0/24HRS		PGTW
54	082046	21.3N 112.5E	PCN 3			RODN
55	090000	21.5N 112.3E	PCN 6			PGTW
56	090026	21.4N 112.4E	PCN 3	T3.0/3.0	INIT OBS	RPMK
57	090137	21.8N 111.9E	PCN 3			PGTW
58	090600	22.0N 111.4E	PCN 6			PGTW
59	090749	22.0N 109.7E	PCN 5			RODN
60	091127	22.1N 109.8E	PCN 5			RSKO
* 61	091138	22.0N 107.2E	PCN 6			RODN
62	091138	22.6N 109.9E	PCN 6			RPMK

AIRCRAFT FIXES

FIX NO	TIME (Z)	FIX POSITION	FLT LVL	700MB HGT	OBS MSLP	MAX-SFC-WND VEL/BRG/RNG	MAX-FLT-LVL-WND DIR/VEL/BRG/RNG	ACCRY NAV/MET	EYE SHAPE	EYE ORIEN-DIAM/TATION	EYE TEMP (C) OUT/ IN/ DP/SST	MSN NO
1	080034	19.2N 115.6E	1500FT		997	60 050 30	170 61 080 95	20 5			+23 +23 31	6
2	080251	19.7N 115.5E	700MB	3038	997	55 050 60	150 51 060 49	20 5			+10 +11 + 9	6

RADAR FIXES

FIX NO.	TIME (Z)	FIX POSITION	RADAR	ACCRY	EYE SHAPE	EYE DIAM	RADOB-CODE ASWAR TDDFF	COMMENTS	RADAR POSITION	SITE WMO NO.
* 1	051500	15.8N 123.6E	LAND				21900 5////	EYE 90 PCT ELIP	15.8N 121.6E	98333
2	070230	17.3N 118.2E	LAND				4//// 43406		16.3N 120.6E	98321
* 3	070900	19.0N 120.6E	LAND				1020/ /////		16.3N 120.6E	98321

4	080300	19.2N	115.3E	LAND	3////	/////	22.3N	114.2E	45005
5	080500	19.3N	115.3E	LAND	6////	/////	22.3N	114.2E	45005
6	080540	19.6N	114.6E	LAND	5////	/////	22.3N	114.2E	45005
7	080600	19.6N	114.6E	LAND	6////	/////	22.3N	114.2E	45005
8	080700	19.7N	114.6E	LAND	5////	/////	22.3N	114.2E	45005
9	080800	19.8N	114.4E	LAND	5////	63107	22.3N	114.2E	45005
10	080900	19.8N	114.3E	LAND	5////	73107	22.3N	114.2E	45005
11	081000	20.0N	114.1E	LAND	5////	/////	22.3N	114.2E	45005
12	081100	20.0N	114.2E	LAND	5////	/////	22.3N	114.2E	45005
13	081200	20.2N	113.7E	LAND	6////	/////	22.3N	114.2E	45005
14	081300	20.2N	113.6E	LAND	5////	/////	22.3N	114.2E	45005
15	081400	20.2N	113.5E	LAND	5////	/////	22.3N	114.2E	45005
16	081500	20.2N	113.4E	LAND	5///1	72806	22.3N	114.2E	45005
17	081600	20.3N	113.3E	LAND	5///1	73006	22.3N	114.2E	45005
18	081700	20.8N	113.0E	LAND	5///1	/////	22.3N	114.2E	45005
19	081800	20.6N	112.9E	LAND	5///1	73012	22.3N	114.2E	45005
20	081900	20.8N	112.8E	LAND	5///1	73112	22.3N	114.2E	45005
21	082000	20.8N	112.6E	LAND	5///1	/////	22.3N	114.2E	45005
22	082100	20.9N	112.6E	LAND	5///1	73110	22.3N	114.2E	45005
23	082200	21.0N	112.5E	LAND	5///1	/////	22.3N	114.2E	45005
24	082300	21.2N	112.4E	LAND	5///3	73310	22.3N	114.2E	45005
25	090000	21.1N	112.2E	LAND	6///3	73008	22.3N	114.2E	45005
26	090100	21.2N	112.1E	LAND	5////	73110	22.3N	114.2E	45005
27	090200	21.4N	112.0E	LAND	5///3	83209	22.3N	114.2E	45005
28	090300	21.6N	111.7E	LAND	5///3	73114	22.3N	114.2E	45005
29	090400	21.8N	111.5E	LAND	5///4	83210	22.3N	114.2E	45005
30	090500	21.9N	111.2E	LAND	6////	83113	22.3N	114.2E	45005
31	090600	21.9N	110.8E	LAND	6///3	53109	20.0N	110.4E	59758

NOTICE - THE ASTERISKS (*) INDICATE FIXES UNREPRESENTATIVE AND NOT USED FOR BEST TRACK PURPOSES.

TYPHOON CARY
BEST TRACK DATA

	BEST TRACK		WARNING		ERRORS		24 HOUR FORECAST		ERRORS		48 HOUR FORECAST		ERRORS		72 HOUR FORECAST		ERRORS	
MO/DA/HR	POSIT	WIND	POSIT	WIND	DST	WIND	POSIT	WIND	DST	WIND	POSIT	WIND	DST	WIND	POSIT	WIND	DST	WIND
070506Z	16.5 152.8	20	0.0 0.0	0	-0	0	0.0 0.0	0	-0	0	0.0 0.0	0	-0	0	0.0 0.0	0	-0	0
070512Z	16.7 152.0	20	0.0 0.0	0	-0	0	0.0 0.0	0	-0	0	0.0 0.0	0	-0	0	0.0 0.0	0	-0	0
070518Z	16.8 151.2	20	0.0 0.0	0	-0	0	0.0 0.0	0	-0	0	0.0 0.0	0	-0	0	0.0 0.0	0	-0	0
070600Z	16.9 150.3	25	0.0 0.0	0	-0	0	0.0 0.0	0	-0	0	0.0 0.0	0	-0	0	0.0 0.0	0	-0	0
070606Z	17.1 149.5	25	0.0 0.0	0	-0	0	0.0 0.0	0	-0	0	0.0 0.0	0	-0	0	0.0 0.0	0	-0	0
070612Z	17.3 148.6	25	0.0 0.0	0	-0	0	0.0 0.0	0	-0	0	0.0 0.0	0	-0	0	0.0 0.0	0	-0	0
070618Z	17.6 147.7	25	0.0 0.0	0	-0	0	0.0 0.0	0	-0	0	0.0 0.0	0	-0	0	0.0 0.0	0	-0	0
070700Z	18.0 146.9	25	17.8 146.5	25	26	0	17.8 141.5	35	285	-15	18.3 137.4	40	474	-20	19.3 133.4	50	642	-40
070706Z	18.6 146.6	30	18.6 146.2	30	23	0	20.2 144.9	40	52	-10	21.1 143.0	45	114	-15	21.2 140.8	50	212	-40
070712Z	19.0 146.4	35	19.5 146.1	30	34	-5	21.2 144.7	40	56	-10	22.7 143.3	45	95	-20	24.2 141.6	50	204	-30
070718Z	19.5 146.2	40	19.4 145.9	30	18	-10	20.8 144.4	40	59	-15	22.1 142.9	50	95	-25	23.3 141.3	60	210	-15
070800Z	19.9 146.0	50	20.0 145.8	45	13	-5	21.7 144.7	60	17	0	23.7 143.1	70	133	-20	25.9 142.2	75	242	5
070806Z	20.4 145.8	50	20.3 145.8	50	6	0	21.9 144.9	60	6	0	24.0 143.4	70	135	-20	26.3 142.3	75	255	10
070812Z	20.8 145.6	50	20.7 145.5	50	8	0	22.6 145.0	65	51	0	25.0 144.7	70	168	-10	27.4 145.1	65	191	0
070818Z	21.3 145.3	55	21.3 145.3	60	0	5	23.7 144.5	70	108	-5	25.7 144.3	75	196	0	28.3 146.0	65	206	-5
070900Z	21.7 145.0	60	21.9 145.0	60	12	0	24.2 144.6	70	138	-20	27.0 144.9	75	236	5	31.1 147.5	55	326	-15
070906Z	21.8 144.9	60	22.0 144.9	60	12	0	24.3 144.5	75	138	-15	27.7 145.2	80	239	15	31.7 148.2	60	321	-15
070912Z	21.8 144.7	65	22.0 144.8	65	13	0	23.6 144.4	90	85	10	26.8 145.0	95	164	30	31.0 147.7	65	266	-10
070918Z	21.9 144.6	75	22.0 144.5	75	8	0	23.5 144.2	95	75	20	27.0 145.3	85	161	15	31.5 148.2	60	263	-15
071000Z	21.9 144.5	90	21.9 144.5	85	0	-5	22.7 144.0	95	81	25	24.7 144.1	105	225	35	28.3 145.9	115	280	45
071006Z	22.0 144.5	90	22.0 144.4	90	6	0	22.9 144.0	105	128	40	25.0 144.1	115	278	40	28.7 145.8	120	316	55
071012Z	22.2 144.6	80	22.0 144.4	80	16	0	23.4 144.4	95	150	30	26.5 145.0	105	264	30	30.0 147.2	105	267	45
071018Z	22.5 145.0	75	22.2 144.7	80	25	5	23.4 144.8	90	175	20	25.7 145.2	95	306	20	28.8 146.4	95	332	40
071100Z	23.1 145.4	70	23.1 145.4	70	0	0	26.0 147.3	65	47	-5	29.2 149.1	55	123	-15	33.7 151.1	50	216	5
071106Z	23.8 146.1	65	23.8 146.1	70	0	5	26.9 148.3	65	48	-10	31.2 150.7	55	144	-10	36.4 152.9	45	324	5
071112Z	24.6 146.8	65	24.6 146.8	70	0	5	27.7 149.0	65	64	-10	32.0 151.3	55	159	-5	0.0 0.0	0	-0	0
071118Z	25.1 147.4	70	25.2 147.5	65	8	-5	28.2 149.9	55	48	-20	32.5 152.3	45	151	-10	0.0 0.0	0	-0	0
071200Z	25.7 148.1	70	25.6 148.2	65	8	-5	28.6 150.3	55	51	-15	32.7 152.0	45	144	0	0.0 0.0	0	-0	0
071206Z	26.4 149.0	75	26.2 148.9	75	13	0	29.8 151.2	65	57	0	34.0 152.7	55	180	15	0.0 0.0	0	-0	0
071212Z	27.0 149.9	75	26.9 149.8	75	8	0	30.7 152.8	60	77	0	0.0 0.0	0	-0	0	0.0 0.0	0	-0	0
071218Z	27.6 150.5	75	27.7 150.7	75	12	0	31.8 153.7	55	122	0	0.0 0.0	0	-0	0	0.0 0.0	0	-0	0
071300Z	28.3 151.2	70	28.4 151.4	70	12	0	32.2 154.2	50	130	5	0.0 0.0	0	-0	0	0.0 0.0	0	-0	0
071306Z	29.0 151.8	65	29.2 152.0	65	16	0	33.0 154.7	55	151	15	0.0 0.0	0	-0	0	0.0 0.0	0	-0	0
071312Z	29.5 152.3	60	29.9 152.8	60	35	0	0.0 0.0	0	-0	0	0.0 0.0	0	-0	0	0.0 0.0	0	-0	0
071318Z	30.0 152.6	55	30.3 152.9	55	24	0	0.0 0.0	0	-0	0	0.0 0.0	0	-0	0	0.0 0.0	0	-0	0
071400Z	30.4 152.8	45	30.4 152.7	40	5	-5	0.0 0.0	0	-0	0	0.0 0.0	0	-0	0	0.0 0.0	0	-0	0
071406Z	31.0 152.9	40	30.5 153.0	40	30	0	0.0 0.0	0	-0	0	0.0 0.0	0	-0	0	0.0 0.0	0	-0	0

	ALL FORECASTS				TYPHOONS WHILE OVER 35 KTS			
	WRNG	24-HR	48-HR	72-HR	WRNG	24-HR	48-HR	72-HR
AVG FORECAST POSIT ERROR	13	92	190	282	12	92	190	282
AVG RIGHT ANGLE ERROR	7	56	149	246	6	56	149	246
AVG INTENSITY MAGNITUDE ERROR	2	12	17	22	2	12	17	22
AVG INTENSITY BIAS	-1	1	2	1	-1	1	2	1
NUMBER OF FORECASTS	30	26	22	18	28	26	22	18

DISTANCE TRAVELED BY TROPICAL CYCLONE IS 1355 NM

AVERAGE SPEED OF TROPICAL CYCLONE IS 6. KNOTS

TYPHOON CARY
FIX POSITIONS FOR CYCLONE NO. 5

SATELLITE FIXES

FIX NO.	TIME (Z)	FIX POSITION	ACCRY	DVORAK CODE	COMMENTS	SITE
1	050759	16.7N 152.7E	PCN 6	T1.0/1.0	INIT OBS	PGTW
2	052039	16.3N 150.9E	PCN 5			PGTW
3	060000	16.4N 150.3E	PCN 6			PGTW
4	060502	17.7N 150.6E	PCN 5	T2.0/2.0 /D1.0/21HRS	ULCC FIX	PGTW
5	060919	17.7N 149.7E	PCN 6			PGTW
* 6	061156	18.3N 149.1E	PCN 6			PGTW
* 7	061747	19.0N 148.7E	PCN 5	T2.0/2.0	INIT OBS	PGTW
8	062018	17.9N 147.0E	PCN 5			PGTW
9	062152	17.6N 146.9E	PCN 3		EXP LLCC	PGTW
10	070000	17.9N 147.1E	PCN 4		EXP LLCC	PGTW
11	070036	17.8N 147.2E	PCN 4		EXP LLCC	PGTW
12	070449	18.2N 146.7E	PCN 6	T2.0/2.0 /S0.2/23HRS	ULCC 18.9N 147.1E	PGTW
13	070600	18.7N 146.9E	PCN 6		ULCC FIX	PGTW
14	070857	19.2N 146.4E	PCN 5		ULCC FIX	PGTW
15	071200	19.7N 146.2E	PCN 6			PGTW
16	071317	18.6N 146.5E	PCN 5			PGTW
17	071735	18.9N 146.0E	PCN 5	T2.5/2.5 /D0.5/24HRS		PGTW
18	071957	19.4N 146.1E	PCN 5			PGTW
19	072128	19.7N 145.8E	PCN 5			PGTW
20	080016	20.0N 145.6E	PCN 3			PGTW
21	080016	19.8N 145.4E	PCN 5	T3.0/3.0	INIT OBS	RODN
22	080619	20.2N 145.6E	PCN 5	T3.5/3.5-/D1.5/26HRS		PGTW
23	080836	20.5N 145.1E	PCN 5		ULCC FIX	PGTW
24	081200	20.5N 145.3E	PCN 6		ULCC FIX	PGTW
25	081257	20.7N 145.2E	PCN 6			PGTW
26	081800	21.5N 145.2E	PCN 6	T4.0/4.0 /D1.5/24HRS	EYEWALL OPN TO NE AND WSW	PGTW
27	082104	21.6N 145.0E	PCN 6			PGTW
28	082356	21.8N 145.0E	PCN 3			PGTW
29	090607	21.9N 144.9E	PCN 3	T4.0/4.0 /D0.5/24HRS		PGTW
30	090815	22.0N 144.8E	PCN 4			PGTW
31	090943	21.7N 144.7E	PCN 3			PGTW
32	091200	22.0N 144.5E	PCN 2		EYE DIA 24NM	PGTW
33	091236	21.8N 144.3E	PCN 2			PGTW
34	091800	21.7N 144.5E	PCN 2	T4.5/4.5 /D0.5/24HRS		PGTW
35	091852	22.2N 144.4E	PCN 2			PGTW
36	092055	21.8N 144.7E	PCN 1			PGTW
37	092221	22.0N 144.5E	PCN 1			PGTW
38	092336	21.9N 144.5E	PCN 1			PGTW
39	092336	21.9N 144.4E	PCN 3	T5.0/5.0	INIT OBS	RODN
40	100554	22.0N 144.4E	PCN 1	T5.0/5.0 /D1.0/24HRS		PGTW
41	100554	22.0N 144.4E	PCN 1	T5.5/5.5	INIT OBS	RPMK
42	100918	22.0N 144.6E	PCN 1			PGTW
43	101200	22.1N 144.5E	PCN [illegible]			PGTW
44	101216	22.1N 144.6E	PCN [illegible]			PGTW
45	101800	22.2N 144.8E	PCN [illegible]	[illegible] 0/4.5 /W0.5/24HRS		PGTW
46	101839	22.4N 144.9E	PCN 2			PGTW
47	102034	22.8N 145.0E	PCN 3			PGTW
48	102157	23.0N 145.2E	PCN 3			PGTW
49	102315	21.3N 145.3E	PCN 3			PGTW
50	110056	23.2N 145.6E	PCN 3			PGTW
51	110057	23.9N 145.6E	PCN 4	T4.0/4 [illegible]	INIT OBS	RSKO
52	110542	23.8N 146.1E	PCN 3	T4.0/5.0-/[illegible]/24HRS		PGTW
53	110542	23.7N 146.4E	PCN 2	T5.0/5.5 /W[illegible] 5/24HRS		RPMK
54	110914	24.2N 146.3E	PCN 1		EYE DIA 30NM	PGTW
55	111156	24.6N 146.9E	PCN 4		EYE DIS 30NM	PGTW
56	111200	24.5N 146.9E	PCN 4			PGTW
57	111811	25.6N 147.6E	PCN 2			RSKO
58	111826	25.1N 147.4E	PCN 2	T4.5/4.5-/D0.5/24HRS		PGTW
59	112013	25.3N 147.6E	PCN 2			PGTW
60	112132	25.4N 147.9E	PCN 2			PGTW
61	120037	25.8N 148.4E	PCN 1			PGTW
62	120529	26.2N 149.2E	PCN 1	T5.0/5.0-/D1.0/24HRS		PGTW
63	120529	26.3N 149.0E	PCN 3	T4.0/4.0	INIT OBS	RODN
64	121200	27.0N 149.9E	PCN 2			PGTW
65	121317	27.0N 150.2E	PCN 1		40NM EYE	PGTW

66	121800	27 [illegible]N 150 7E	PCN 2	T4 5 4 5-/50 0/24HRS		PGTW
67	121814	27 9N 150.7E	PCN 2			PODN
68	121952	27 [illegible]N 150 3E	PCN 2			PGTW
69	122108	28 0N 151 1E	PCN 1		50NM EYE	PGTW
70	130016	28 2N 151 3E	PCN 1			PGTW
71	130600	29 2N 151 5E	PCN 2	T4 0/4.0-/W1.0/24HRS		PGTW
72	130832	29 2N 152 2E	PCN 4			PGTW
* 73	131200	29 6N 153.2E	PCN 4			PGTW
74	131257	29 7N 152 9E	PCN 3			PGTW
75	131802	30 0N 152 2E	PCN 3	T3.0/3.0 /W1 5/24HRS		PGTW
76	131931	29 8N 152 6E	PCN 4		EXP LLCC	PGTW
77	132356	30 1N 152 9E	PCN 3			PGTW
78	140504	30 3N 153 1E	PCN 3	T3.0/3.0 /W1.0/23HRS		PGTW
79	140811	31 5N 152 8E	PCN 4			PGTW
80	141200	30 6N 153 1E	PCN 4			PGTW
81	141237	31 7N 152.8E	PCN 3		EXP LLCC	PGTW
82	150931	31 9N 152 9E	PCN 3		EXP LLCC	PGTW
83	152029	31 4N 151 6E	PCN 3			PGTW
84	160909	30 7N 151 0E	PCN 2			PGTW
85	171947	29 9N 145 2E	PCN 4			PGTW

AIRCRAFT FIXES

FIX NO	TIME (Z)	FIX POSITION	FLT LVL	700MB HGT	OBS MSLP	MAX-SFC-WND VEL/BRG/RNG	MAX-FLT-LVL-WND DIR/VEL/BRG/RNG	ACCRY NAV/MET	EYE SHAPE	EYE ORIEN- DIAM/TATION	EYE TEMP (C) OUT/ IN/ DP/SST	MSN NO
1	062257	17 6N 146 9E	1500FT		1004	25 050 10	140 20 050 10	3 1			+23 +23 +22 30	1
2	070652	18 9N 146 7E	1500FT		1002	40 040 60	090 35 010 5					2
3	070845	18 9N 146 3E	1500FT		999	40 020 5	040 40 330 15	5 1			+21 +24 +24	2
4	072128	19 9N 146 0E	700MB	3035		50 240 25	330 58 280 30	5 10				3
5	080004	20 0N 146 0E	1500FT		991	50 010 20	020 35 300 60	5 5			+23 +25 +25	3
6	080530	20 3N 146 0E	1500FT		987	55 220 25	100 63 360 40	7 2			+22 +26 +24 29	4
7	080807	20 6N 145 9E	1500FT		989	45 090 30	170 50 090 30	5 2			+22 +26 +24 29	4
8	082353	21 8N 145.1E	700MB	2964		45 180 35	250 44 180 60	5 2			+12 +14 +12	6
9	090245	21.8N 144.9E	700MB	2942	981	45 330 70	030 44 330 60	5 2			+11 +24 +24	6
10	090836	21 8N 144 7E	700MB	2894	977	45 180 10	140 51 010 55	5 10				8
11	091125	21.9N 144.7E	700MB	2887	975		310 71 220 25	5 10	CIRCULAR	30	+10 +14 +11	8
12	092100	21.8N 144.5E	700MB	2721		65 360 60	080 88 360 35	7 5			+10 +19 + 9	10
13	092332	21.9N 144.5E	700MB	2723	955	90 270 45	360 82 270 40	6 5	CIRCULAR	25	+13 +18 +10	10
14	100855	22.1N 144.5E	700MB	2791	967	50 180 60	330 78 240 18	12 3			+15 +12	11
15	101130	22.1N 144.6E	700MB	2820	971		330 70 100 25	12 2	CIRCULAR	10	+11 +14 +12	11
16	101953	22.7N 145.2E	700MB	2855		50 290 15	270 70 180 10	10 4			+10 +14 + 9	13
17	102323	23.0N 145.5E	700MB	2875	974	60 040 47	160 65 050 80	7 12			+10 +12 +11	13
18	110837	24 4N 146.6E	700MB	2912	982	60 100 60	190 63 100 30	8 5			+22 +12	14
19	111118	24.5N 146.7E	700MB	2915	982		360 64 240 20	8 5	CIRCULAR	40	+10 +11 +11	14
20	112032	25.4N 147.5E	700MB	2859		50 050 70	310 74 230 44	10 5			+13 +14 +11	15
21	112314	25.2N 148.2E	700MB	2855	974	60 290 75	350 71 320 55	12 5	ELLIPTICAL	30 10 090	+11 +14 +11	15
22	120847	26 7N 149.4E	700MB	2831		50 360 5	240 78 140 30	5 10	CIRCULAR	40	+10 +13 +10	16
23	121141	26 9N 149 8E	700MB	2820			110 60 050 35	5 10	CIRCULAR	40	+ 9 +13 +10	16
24	122053	27 9N 151.0E	700MB	2776		55 230 25	220 82 110 33	10 4	CIRCULAR	35	+11 +14 +10	17
25	122329	28 2N 151.2E	700MB	2777		60 300 60	090 70 360 23	15 3	CIRCULAR	35	+11 +14 +12	17
26	130532	29.1N 151.6E	700MB	2755		55 120 30	210 90 120 65	15 7			+12 +16 +13	18
27	130805	29.3N 152.1E	700MB	2802	965	60 300 75	040 65 300 65	10 6			+13 +15 +11	18
28	132056	30.1N 152.6E	700MB	2876		45 320 40	060 39 340 40	5 15			+12 +10	19
29	132328	30.3N 152.7E	700MB	2889	980	40 050 85	180 46 050 120	5 10			+10 +11 +10	19

NOTICE - THE ASTERISKS (*) INDICATE FIXES UNREPRESENTATIVE AND NOT USED FOR BEST TRACK PURPOSES.

TYPHOON DINAH
BEST TRACK DATA

MO/DA/HR	BEST TRACK POSIT	BEST TRACK WIND	WARNING POSIT	WARNING WIND	WARNING ERRORS DST	WARNING ERRORS WIND	24 HOUR FORECAST POSIT	24 HOUR FORECAST WIND	24 HOUR ERRORS DST	24 HOUR ERRORS WIND	48 HOUR FORECAST POSIT	48 HOUR FORECAST WIND	48 HOUR ERRORS DST	48 HOUR ERRORS WIND	72 HOUR FORECAST POSIT	72 HOUR FORECAST WIND	72 HOUR ERRORS DST	72 HOUR ERRORS WIND
072118Z	21 0 162 2	20	0.0 0.0	0	-0	0	0.0 0 0	0	-0	0	0 0 0 0	0	-0	0	0 0 0 0	0	-0	0
072200Z	21 0 161 3	20	0.0 0.0	0	-0	0	0.0 0 0	0	-0	0	0 0 0 0	0	-0	0	0 0 0 0	0	-0	0
072206Z	21 0 160 9	20	0.0 0 0	0	-0	0	0 0 0 0	0	-0	0	0 0 0 0	0	-0	0	0 0 0 0	0	-0	0
072212Z	20 9 160 4	25	0.0 0 0	0	-0	0	0 0 0 0	0	-0	0	0.0 0 0	0	-0	0	0 0 0 0	0	-0	0
072218Z	20 7 159 8	25	0.0 0 0	0	-0	0	0 0 0 0	0	-0	0	0.0 0 0	0	-0	0	0 0 0 0	0	-0	0
072300Z	20 4 159 1	25	0 0 0 0	0	-0	0	0 0 0 0	0	-0	0	0 0 0 0	0	-0	0	0 0 0.0	0	-0	0
072306Z	20 5 158 6	25	0 0 0 0	0	-0	0	0 0 0 0	0	-0	0	0 0 0.0	0	-0	0	0 0 0 0	0	-0	0
072312Z	21 0 158 2	25	0 0 0 0	0	-0	0	0 0 0 0	0	-0	0	0 0 0 0	0	-0	0	0 0 0 0	0	-0	0
072318Z	21 3 157 8	30	0 0 0 0	0	-0	0	0 0 0 0	0	-0	0	0.0 0.0	0	-0	0	0 0 0 0	0	-0	0
072400Z	21 6 157 3	30	0 0 0 0	0	-0	0	0.0 0 0	0	-0	0	0.0 0.0	0	-0	0	0 0 0 0	0	-0	0
072406Z	21 7 156 4	30	21 9 156 7	30	21	0	23 4 154 6	40	225	-10	26.5 152 4	50	429	-25	30 2 150 3	55	582	-25
072412Z	21 3 155 4	35	21 9 155 9	30	46	-5	22 8 154 0	44	222	-11	24.0 152.0	50	267	-30	25 3 150 3	60	277	-15
072418Z	21 0 154 7	40	21 5 155 0	35	34	-5	22 6 152 3	45	200	-15	23.9 150.5	55	235	-30	25 4 149 1	65	297	-15
072500Z	20 6 153 9	45	20 9 154 0	45	19	0	20 4 149 9	65	107	-5	22.6 146.8	75	235	-10	24 9 145 1	80	424	-5
072506Z	20 0 152 9	50	20 4 152 9	50	24	0	20 7 148 8	70	134	-5	23.1 145.9	75	300	-5	25 6 144 5	80	497	-20
072512Z	19 5 152 2	55	19 7 152 1	60	13	5	20 5 148 5	75	115	-5	22.6 146.3	80	271	5	24 7 145 0	85	472	-30
072518Z	19 3 151 8	60	19 5 151 1	65	41	5	20 3 147 7	75	142	-10	22.6 145.9	80	309	0	24 8 144 7	85	502	-35
072600Z	19 3 151 4	70	19 4 151 3	70	8	0	19 5 149 9	75	51	-10	20.2 148.9	75	154	-10	21 3 148 4	75	313	-50
072606Z	19 5 150 8	75	19 5 150 8	75	0	0	20 5 149 0	80	84	0	22.2 148.0	85	234	-15	24 0 147 1	95	395	-20
072612Z	19 8 150 4	80	20 0 150 4	85	12	5	21 7 149 0	105	112	30	24.3 147 6	115	337	0	27 0 146 9	115	429	10
072618Z	20 0 150 2	85	20 2 150 2	90	12	5	22.2 148 6	110	163	30	24.9 147.2	115	374	-5	27 7 146 7	115	442	15
072700Z	20 3 150.2	85	20 2 150 1	90	8	5	21 6 149 2	75	134	-10	24.2 147.9	75	335	-50	26 8 146 6	75	459	-20
072706Z	20 5 150.5	80	20 5 150 1	90	22	10	22 1 149 3	75	164	-25	24.5 148.0	75	346	-40	26 9 146 3	80	521	-10
072712Z	20 7 150 7	75	20 7 150 5	80	11	5	22 5 150 6	70	140	-45	25.0 149.3	75	288	-30	27 5 147 7	80	490	0
072718Z	20 8 151.1	80	20 8 150 6	85	28	5	22 6 150 6	75	152	-45	25.1 149.3	75	317	-25	27 5 147 5	80	585	10
072800Z	21.0 151.5	85	21 0 151 4	80	6	-5	22 2 152 7	90	71	-35	24.2 153.6	95	248	0	26 3 153 6	100	534	40
072806Z	21.0 152.0	100	21 1 152 0	115	6	15	22 5 153 7	125	96	10	24.5 154.3	135	325	45	26 5 153 8	145	622	95
072812Z	21 1 152.6	115	21.1 152.6	120	0	5	21 6 155 0	135	217	30	24.8 155 5	140	391	60	28 8 155 5	140	559	95
072818Z	21 8 153.2	120	21.4 153 0	125	26	5	23 4 154 9	135	198	35	26.9 155.6	140	366	70	30 8 156 1	130	570	85
072900Z	22 8 153.8	125	22 8 153.7	125	6	0	26 7 153 7	135	112	40	30.2 151.9	140	395	80	33 6 149 6	130	884	85
072906Z	24 0 154.3	115	24 2 154.2	115	13	0	28 7 153 2	120	142	30	31.9 150 4	115	510	65	34 9 147 3	100	1130	60
072912Z	25.2 154 6	105	25 2 154 4	105	11	0	29 2 154 2	85	157	5	32.4 154.9	80	412	35	34 2 155 9	75	969	35
072918Z	26 7 154 9	100	26 4 154 5	100	28	0	30 4 154 6	80	191	10	33.5 155.1	70	500	25	36 3 157 0	60	1009	20
073000Z	28.1 155.1	95	28.2 155.0	100	8	5	31 2 154 6	75	254	15	34.8 155 8	65	578	20	0 0 0 0	0	-0	0
073006Z	29.8 155.6	90	29.7 155.4	95	12	5	35 7 157 8	60	88	10	41 2 164 8	30	254	-10	0.0 0 0	0	-0	0
073012Z	31.3 156.0	80	31 3 156.0	80	0	0	36 9 159 2	50	106	5	0.0 0 0	0	-0	0	0 0 0 0	0	-0	0
073018Z	32.9 156.9	70	32 7 156 9	70	12	0	39 2 162 2	45	116	0	0 0 0 0	0	-0	0	0 0 0 0	0	-0	0
073100Z	34.4 157.9	60	34.4 157 9	65	0	5	40 1 164 2	40	126	-5	0 0 0 0	0	-0	0	0 0 0 0	0	-0	0
073106Z	35 6 159.6	50	35 8 159 6	55	12	5	39 2 168 2	30	107	-10	0 0 0.0	0	-0	0	0.0 0 0	0	-0	0
073112Z	36 7 161.4	45	36.6 162 4	50	49	5	0 0 0 0	0	-0	0	0 0 0 0	0	-0	0	0 0 0 0	0	-0	0
073118Z	37.8 163.9	45	37 4 164 1	45	26	0	0 0 0.0	0	-0	0	0.0 0 0	0	-0	0	0 0 0 0	0	-0	0
080100Z	39 1 166.6	45	38.7 165 5	40	57	-5	0 0 0 0	0	-0	0	0 0 0.0	0	-0	0	0 0 0 0	0	-0	0
080106Z	40.1 170.2	40	40.0 169 5	40	33	0	0 0 0 0	0	-0	0	0 0 0 0	0	-0	0	0 0 0 0	0	-0	0
080112Z	41.1 174.4	40	41.0 175.0	40	28	0	0 0 0 0	0	-0	0	0.0 0 0	0	-0	0	0 0 0 0	0	-0	0
080118Z	42.8 177.2	40	43 0 179 0	40	80	0	0 0 0 0	0	-0	0	0 0 0 0	0	-0	0	0 0 0 0	0	-0	0

	ALL FORECASTS WRNG	24-HR	48-HR	72-HR	TYPHOONS WHILE OVER 35 KTS WRNG	24-HR	48-HR	72-HR
AVG FORECAST POSIT ERROR	20	142	336	564	20	142	336	564
AVG RIGHT ANGLE ERROR	11	73	178	284	11	73	178	284
AVG INTENSITY MAGNITUDE ERROR	3	17	28	35	3	17	28	35
AVG INTENSITY BIAS	2	0	5	13	2	0	5	13
NUMBER OF FORECASTS	35	29	25	23	34	29	25	23

DISTANCE TRAVELED BY TROPICAL CYCLONE IS 2826. NM

AVERAGE SPEED OF TROPICAL CYCLONE IS 11. KNOTS

TYPHOON DINAH
FIX POSITIONS FOR CYCLONE NO 6

SATELLITE FIXES

FIX NO	TIME (Z)	FIX POSITION	ACCRY	DVORAK CODE	COMMENTS	SITE
1	211800	21 1N 162 5E	PCN 6	T1.0/1.0	INIT OBS	PGTW
2	220000	20 9N 161 4E	PCN 6	T0.5/0.5	INIT OBS	PGTW
3	220600	21 2N 160 7E	PCN 6		ULCC FIX	PGTW
4	221200	20 4N 159 9E	PCN 6			PGTW
5	221800	20 6N 160 1E	PCN 6	T1.0/1.0+/S0.0/24HRS		PGTW
6	221942	20 3N 159 1E	PCN 5			PGTW
7	230000	20 4N 159 0E	PCN 6	T1.0/1.0 /D0.5/24HRS		PGTW
8	230600	20 4N 158 3E	PCN 6		ULCC FIX	PGTW
* 9	230822	22 3N 158 6E	PCN 5			PGTW
10	231921	21 8N 157 7E	PCN 5	T0.5/1.0+/W0.5/24HRS		PGTW
11	240000	21 4N 157 3E	PCN 6		ULCC FIX	PGTW
12	240441	21 5N 156 2E	PCN 6	T2.0/2.0 /D1.0/28HRS		PGTW
13	240600	21 6N 156 2E	PCN 6			PGTW
14	240801	21 8N 155 8E	PCN 6			PGTW
15	241200	20 7N 155 1E	PCN 6			PGTW
16	241726	20 7N 154 0E	PCN 5		ULCC FIX	PGTW
17	241800	21 0N 154 0E	PCN 6	T2.5/2.5	INIT OBS ULCC FIX	PGTW
18	241900	20 5N 153 7E	PCN 6			PGTW
19	242337	21 0N 153 9E	PCN 5			PGTW
20	242337	20 7N 154 0E	PCN 5	T2.5/2.5	INIT OBS	RODN
21	250600	20 4N 152 5E	PCN 6	T3.5/3.5 /D1.5/25HRS		PGTW
22	250813	20 0N 152 6E	PCN 6			PGTW
23	251200	19 5N 153 0E	PCN 6			PGTW
24	251217	19 6N 152 7E	PCN 6			PGTW
25	251217	19 6N 153 5E	PCN 5			RODN
26	251713	19 3N 151 7E	PCN 6			PGTW
27	251800	19 0N 151 9E	PCN 6	T4.0/4.0 /D1.5/24HRS		PGTW
28	252020	19 1N 151 4E	PCN 3		EYEWALL E-S-W OPN NW-NE	PGTW
29	252057	19 1N 151 3E	PCN 3			PGTW
30	252316	19 4N 151 3E	PCN 3			PGTW
31	260000	19 5N 151 4E	PCN 4			PGTW
32	260558	19 8N 150 8E	PCN 1	T4.5/4.5 /D1.5/24HRS		PGTW
33	260558	19 7N 150 9E	PCN 1	T5.0/5.0	INIT OBS	RODN
34	260900	19 7N 150 5E	PCN 2			PGTW
35	261157	19 2N 150 3E	PCN 2			PGTW
36	261300	20 2N 150 3E	PCN 2	T5.5/5.5-/D1.5/24HRS		PGTW
37	261343	20 2N 150 4E	PCN 2			PGTW
38	261959	19 9N 150 3E	PCN 2			PGTW
39	262214	20 1N 150 2E	PCN 2			PGTW
40	262214	20 2N 149 8E	PCN 2	T5.0/5.0	INIT OBS	RSFO
41	270032	20 3N 150 3E	PCN 1			PGTW
42	270545	20 3N 150 6E	PCN 1	T6.0/6.0 /D1.0/24HRS		RODN
43	270545	20 5N 150 5E	PCN 1	T5.5/5.5-/D1.0/24HRS	EYE FIX	PGTW
44	270911	20 5N 150 4E	PCN 4			PGTW
45	271200	20 5N 150 7E	PCN 2			PGTW
46	271318	20 4N 151 0E	PCN 2			PGTW
47	271830	20 7N 150 8E	PCN 2	T5.0/5.5-/W0.5/24HRS		PGTW
48	271937	20 7N 151 0E	PCN 2			PGTW
49	272143	20 8N 151 2E	PCN 4			PGTW
50	280017	20 9N 151 5E	PCN 1		EYE FIX	PGTW
51	280532	21 0N 151 9E	PCN 1	T6.0/6.0 /S0.0/24HRS	EYE FIX	RODN
52	280533	21 0N 152 0E	PCN 1	T6.0/6.0 /D0.5/24HRS		PGTW
53	280847	21 0N 152 0E	PCN 1		EYE DIA 15NM	PGTW
54	281258	20 9N 152 3E	PCN 2			PGTW
55	281818	22 1N 153 0E	PCN 2			RODN
56	281818	21 5N 152 6E	PCN 2	T6.5/6.5 /D0.5/24HRS		PGTW
57	282158	22 8N 153 8E	PCN 1		EYE DIA 12NM	RODN
58	290000	22 9N 153 8E	PCN 2	T5.5/5.5	INIT OBS	PGTW

59	[illegible]	[illegible]	PCN 2			PGTW
60	[illegible]	[illegible]	PCN 4			RPDN
61	[illegible]	[illegible]	PCN 6	T5 0 5 0	INIT OBS	PGTW
62	[illegible]	[illegible]	PCN 4			RPDN
63	[illegible]	[illegible]	[illegible]	T5 0 6 0 /W1 0/24HRS		RPDN
64	[illegible]	[illegible]	PCN 4	T4 5 5 5 /W1 0 24HRS	EYEWALL OPN N-E-S	PGTW
65	[illegible]	[illegible]	PCN 3			RPDN
66	[illegible]	[illegible]	PCN 4			PGTW
67	300915	[illegible]	[illegible]			[illegible]
68	[illegible]	[illegible]	PCN 4			[illegible]
69	[illegible]	[illegible]	[illegible]			PGTW
70	301218	[illegible]	PCN 4			RPDN
71	[illegible]	[illegible]	[illegible]	T3 5 4 5 /W1 5 24HRS	ULCC FIX	PGTW
72	[illegible]	[illegible]	PCN 6			RPDN
73	[illegible]	[illegible]	[illegible]			PGTW
74	[illegible]	[illegible]	PCN 4			[illegible]
75	[illegible]	[illegible]	PCN 4	T3 0 4 5 W1 5 29HRS		[illegible]
76	[illegible]	[illegible]	[illegible]	[illegible]	INIT OBS ULAC 36 2N 160 9E	[illegible]
77	[illegible]	[illegible]	[illegible]		ULAC 36 5N 161 0E	[illegible]
78	311740	[illegible]	[illegible]		ULAC 38 4N 163 6E	[illegible]
79	[illegible]	[illegible]	[illegible]		ULAC 38 0N 163 6E	[illegible]
80	[illegible]	[illegible]	PCN 6	T3 0 3 0	INIT OBS	[illegible]
81	010000	[illegible]	PCN 6	T3 0 3 0	INIT OBS ULCC FIX	PGTW
82	010600	[illegible]	[illegible]		ULCC FIX	PGTW
83	[illegible]	[illegible]	PCN 6	T2 5 3 0 /W0 5/14HRS		[illegible]
84	[illegible]	[illegible]	PCN 6			[illegible]
85	[illegible]	[illegible]	PCN 6			[illegible]

AIRCRAFT FIXES

FIX NO	TIME (Z)	FIX POSITION	FLT LVL	700MB HGT	OBS MSLP	MAX-SFC-WND VEL/BRG/RNG			MAX-FLT-LVL-WND DIR VEL BRG/RNG				ACCRY NAV MET		EYE SHAPE	EYE ORIEN- DIAM/TATION			EYE TEMP (C) OUT/ IN/ DP/SST				MSN NO
1	240250	21 7N 156 9E	1500FT		1000	30	070	40	160	38	070	40	5	0					+25	+25	+24	30	2
2	240537	21 8N 156 7E	1500FT		999	25	260	60	360	32	230	30	10	0						+25	+25		2
3	242057	20 8N 154 5E	700MB	3007	990	60	050	7	030	45	350	15	3	5	CIRCULAR	20							3
4	242352	20 8N 153 9E	700MB	3021	992	45	310	3	070	64	020	15	3	5	CIRCULAR	20			+14	+13	+ 8		3
5	250624	20 1N 152 8E	700MB	3009	987	65	110	30	040	39	350	30	5	5					+12	+13	+13		4
6	250826	19 9N 152 6E	700MB	3002	990	65	040	10	110	72	040	10	7	5	CIRCULAR	25			+12	+15	+ 8		4
7	252046	19 8N 151 7E	700MB	2923		50	130	15	230	68	130	20	5	2					+10	+15	+ 9		5
8	252323	19 5N 151 5E	700MB	2906	976	75	310	20	110	86	020	15	5	1	CIRCULAR	30			+10	+16	+ 9		5
9	260923	19 9N 150 7E	700MB	2731					300	73	220	15	5	10									7
10	261157	19 9N 150 5E	700MB	2719	958	30	290	60	130	97	050	13	3	5	CIRCULAR	13			+10	+16			7
11	262037	20 1N 150 3E	700MB	2689		80	230	45	290	67	230	30	10	5	CIRCULAR	12							8
12	262319	20 2N 150 2E	700MB	2697	956	110	030	10	240	80	310	10	10	5	CIRCULAR	13			+12	+16	+11		8
13	270831	20 7N 150 7E	700MB	2770		50	230	60	310	71	220	31	8	3	CIRCULAR	15			+11	+13	+13		9
14	271104	20 2N 150 7E	700MB	2790	967				030	62	300	30	8	2	CIRCULAR	10			+11	+14	+12		9
15	272139	20 9N 151 3E	700MB	2764	962	65	180	10	330	78	250	15	3	5	CIRCULAR	15							10
16	272350	21 0N 151 4E	700MB	2761	962	75	300	30	030	67	300	30	3	3	CIRCULAR	15			+11	+14	+12		10
17	280832	21 1N 152 0E	700MB	2470		120	240	10	310	105	240	10	4	3	CIRCULAR	15			+12	+21	+ 8		11
18	281123	20 9N 152 6E	700MB	2382	917				350	116	300	10	6	3	CIRCULAR	12			+14	+25	+10		11
19	282042	22 3N 153 4E	700MB	2351		110	360	2	290	116	220	19	8	2	CIRCULAR	10			+14	+22	+14		12
20	282328	22 7N 153 6E	700MB	2349	916	100	040	7	130	97	020	10	8	2	CIRCULAR	10			+13	+22	+14		12
21	290845	24 4N 154 3E	700MB	2464	929	70	240	20	220	85	110	30	15	5	ELLIPTICAL	15	5	050	+12	+17	+15		13
22	291139	25 1N 154 4E	700MB	2521	935				150	82	080	28	15	5	ELLIPTICAL	20	10	050	+12	+16	+16		13
23	292116	27 6N 155 0E	700MB	2603		50	210	30	300	80	210	35	10	5						+15	+14		15
24	292326	28 0N 155 0E	700MB	2610	943	50	210	30	150	85	070	21	10	5	CIRCULAR	7			+11	+15	+15		15
25	300834	30 4N 155 9E	700MB	2686		65	200	50	250	68	180	8	10	2	CIRCULAR	8			+13	+14	+14		16
26	301032	31 0N 155 9E	700MB	2722	959				210	83	130	24	10	2	CIRCULAR	5			+14	+15	+15		16
27	302114	33 7N 157 4E	1500FT		967	45	280	90	360	41	270	120	10	10					+22	+24			17
28	302345	34 3N 157 9E	700MB	2826	970	45	050	120	140	60	050	120	10	10					+14	+16			17

NOTICE - THE ASTERISKS (*) INDICATE FIXES UNREPRESENTATIVE AND NOT USED FOR BEST TRACK PURPOSES

TYPHOON ED
BEST TRACK DATA

MO/DA/HR	BEST TRACK POSIT	BEST TRACK WIND	WARNING POSIT	WARNING WIND	WARNING ERRORS DST	WARNING ERRORS WIND	24 HOUR FORECAST POSIT	24 HR WIND	24 HR ERRORS DST	24 HR ERRORS WIND	48 HOUR FORECAST POSIT	48 HR WIND	48 HR ERRORS DST	48 HR ERRORS WIND	72 HOUR FORECAST POSIT	72 HR WIND	72 HR ERRORS DST	72 HR ERRORS WIND
072506Z	28 0 135 1	25	0 0 0 0	0	-0	0	0 0 0 0	0	-0	0	0 0 0 0	0	-0	0	0 0 0 0	0	-0	0
072512Z	27 0 135 6	30	0 0 0 0	0	-0	0	0 0 0 0	0	-0	0	0 0 0 0	0	-0	0	0 0 0 0	0	-0	0
072518Z	26 2 136 4	35	26 2 136 4	30	0	-5	24 3 140 1	45	129	-5	22 9 144 2	25	457	-40	0 0 0 0	0	-0	0
072600Z	25 9 137 5	45	25 8 137 3	55	12	10	25 2 140 0	70	114	20	24 6 142 4	55	361	-10	21 7 145 2	45	827	-20
072606Z	25 6 138 7	50	25 6 138 8	55	5	5	24 4 143 0	40	243	-15	21 8 146 1	25	673	-40	0 0 0 0	0	-0	0
072612Z	25 7 140 0	50	25 4 140 1	50	19	0	23 8 144 1	35	363	-25	0 0 0 0	0	-0	0	0 0 0 0	0	-0	0
072618Z	26 4 140 6	50	25 8 141 0	50	42	0	24 3 144 6	35	412	-30	0 0 0 0	0	-0	0	0 0 0 0	0	-0	0
072700Z	27 0 140 7	50	26 7 141 0	40	24	-10	28 5 141 5	35	197	-30	0 0 0 0	0	-0	0	0 0 0 0	0	-0	0
072706Z	27 7 140 4	55	27 6 140 9	40	27	-15	30 0 141 1	30	233	-35	0 0 0 0	0	-0	0	0 0 0 0	0	-0	0
072712Z	28 3 139 6	60	28 3 140 0	55	21	-5	30 8 137 8	45	139	-25	33 1 137 0	25	374	-65	0 0 0 0	0	-0	0
072718Z	28 7 138 7	65	28 7 138 8	60	5	-5	30 7 135 1	40	71	-25	0 0 0 0	0	-0	0	0 0 0 0	0	-0	0
072800Z	29 0 137 8	65	29 0 137 9	60	5	-5	30 1 134 5	60	90	-5	31 4 130 5	60	125	-40	33 3 128 2	45	297	-25
072806Z	29 3 136 7	65	29 4 136 8	65	8	0	30 6 132 9	70	75	-15	31 3 129 9	45	160	-45	32 4 126 9	45	269	-15
072812Z	29 6 135 5	70	29 5 135 5	70	6	0	30 8 131 4	65	68	-25	31 7 128 0	50	150	-30	31 8 124 8	40	191	-10
072818Z	29 8 134 2	65	29 8 134 3	70	5	5	31 0 130 0	55	52	-35	31 3 125 8	45	104	-30	30 8 122 2	35	142	-5
072900Z	29 8 132 8	65	29 8 132 8	70	0	5	30 3 128 2	50	13	-50	30 6 124 1	45	105	25	30 8 120 0	30	152	0
072906Z	29 8 131 8	85	29 8 131 7	95	5	10	29 9 127 5	90	81	0	30 0 124 0	80	181	20	30 1 120 3	65	216	35
072912Z	29 8 130 8	90	29 8 130 7	90	5	0	30 0 126 8	80	117	0	30 3 123 1	70	162	20	31 0 120 0	60	180	35
072918Z	30 2 129 6	90	30 1 129 5	90	8	0	30 8 125 2	80	86	5	31 8 121 7	65	79	25	33 0 118 8	40	93	15
073000Z	30 5 128 3	100	30 4 128 3	90	6	-10	32 2 124 2	85	85	15	33 7 120 0	75	35	45	34 5 117 7	30	95	5
073006Z	31 1 126 8	90	31 1 126 7	90	5	0	33 6 121 1	75	88	15	36 0 115 4	30	278	0	0 0 0 0	0	-0	0
073012Z	31 3 125 1	80	31 4 125 1	80	6	0	33 8 119 5	60	116	10	0 0 0 0	0	-0	0	0 0 0 0	0	-0	0
073018Z	31 6 123 8	75	31 6 123 4	75	20	0	33 4 118 0	45	140	5	0 0 0 0	0	-0	0	0 0 0 0	0	-0	0
073100Z	31 8 122 6	70	31 7 122 4	70	12	0	33 5 117 7	35	141	5	0 0 0 0	0	-0	0	0 0 0 0	0	-0	0
073106Z	32 2 121 6	60	32 1 121 4	60	12	0	34 2 117 2	25	157	-5	0 0 0 0	0	-0	0	0 0 0 0	0	-0	0
073112Z	32 4 121 1	50	32 8 120 8	50	28	0	0 0 0 0	0	-0	0	0 0 0 0	0	-0	0	0 0 0 0	0	-0	0
073118Z	32 8 120 7	40	33 2 120 3	40	31	0	0 0 0 0	0	-0	0	0 0 0 0	0	-0	0	0 0 0 0	0	-0	0
080100Z	33 3 120 5	30	33 2 120 4	30	8	0	0 0 0 0	0	-0	0	0 0 0 0	0	-0	0	0 0 0 0	0	-0	0
080106Z	33 7 120 3	30	33 6 120 2	30	8	0	0 0 0 0	0	-0	0	0 0 0 0	0	-0	0	0 0 0 0	0	-0	0
080112Z	34 0 120 1	25	34 0 120 0	25	5	0	0 0 0 0	0	-0	0	0 0 0 0	0	-0	0	0 0 0 0	0	-0	0
080118Z	34 3 119 8	25	0 0 0 0	0	-0	0	0 0 0 0	0	-0	0	0 0 0 0	0	-0	0	0 0 0 0	0	-0	0
080200Z	34 7 119 6	25	0 0 0 0	0	-0	0	0 0 0 0	0	-0	0	0 0 0 0	0	-0	0	0 0 0 0	0	-0	0
080206Z	35 0 119 4	25	0 0 0 0	0	-0	0	0 0 0 0	0	-0	0	0 0 0 0	0	-0	0	0 0 0 0	0	-0	0

	ALL FORECASTS WRNG	24-HR	48-HR	72-HR	TYPHOONS WHILE OVER 35 KTS WRNG	24-HR	48-HR	72-HR
AVG FORECAST POSIT ERROR	12	140	232	246	13	139	245	345
AVG RIGHT ANGLE ERROR	9	82	117	125	9	81	126	137
AVG INTENSITY MAGNITUDE ERROR	3	17	31	17	4	19	33	15
AVG INTENSITY BIAS	-1	-11	-15	2	-1	-12	-22	-15
NUMBER OF FORECASTS	28	23	14	10	25	21	12	5

DISTANCE TRAVELED BY TROPICAL CYCLONE IS 1700 NM

AVERAGE SPEED OF TROPICAL CYCLONE IS 9 KNOTS

TYPHOON ED
FIX POSITIONS FOR CYCLONE NO 7

SATELLITE FIXES

FIX NO	TIME (Z)	FIX POSITION	ACCRY	DVORAK CODE	COMMENTS	SITE
1	200000	26 6N 141 9E	PCN 6	T1 0/1 0	INIT OBS	PGTW
2	200600	27 0N 142 4E	PCN 6			PGTW
3	201200	26 4N 142 4E	PCN 6			PGTW
4	202025	27 7N 143 3E	PCN 3			PGTW
5	221942	28 5N 146 4E	PCN 5	T1 0/1 0	INIT OBS	PGTW
6	242041	29 7N 135 2E	PCN 3	T1 5/1 5	INIT OBS EXP LLCC	PGTW
7	250610	28 2N 135 2E	PCN 5	T2 0/2 0	INIT OBS	PGTW
8	250921	28 0N 134 9E	PCN 6			PGTW
9	251200	26 3N 136 0E	PCN 6			PGTW
10	251359	26 0N 136 8E	PCN 6		ULCC FIX	PGTW
11	251800	26 2N 136 3E	PCN 6	T2 5/2 5	INIT OBS	PGTW
12	251355	26 2N 135 8E	PCN 6		ULCC FIX	PGTW
13	252020	26 2N 136 1E	PCN 3			PGTW
14	252238	25 9N 136 8E	PCN 3			PGTW
15	260056	25 8N 137 8E	PCN 3			PGTW
16	260558	25 5N 138 7E	PCN 5	T3 5/3 5-/D1 5/24HRS		PGTW
17	260558	25 8N 138 7E	PCN 3	T3 0/3 0	INIT OBS	RSKO
18	260558	25 6N 138 7E	PCN 5	T3 5/3 5	INIT OBS	RODN
19	260900	25 5N 139 2E	PCN 6			PGTW
20	261200	25 4N 140 1E	PCN 6			PGTW
21	261338	25 6N 140 3E	PCN 6			PGTW
22	261800	26 3N 140 6E	PCN 6	T3 5/3 5-/D1 0/24HRS		PGTW
23	261843	26 4N 140 5E	PCN 6		ULCC FIX	PGTW
24	261959	26 2N 140 4E	PCN 6		ULCC FIX	PGTW
25	262214	26 2N 140 5E	PCN 5	T2 5/3 0+/W0 5/16HRS		RSKO
26	262214	26 6N 140 6E	PCN 6		ULCC FIX	PGTW
27	270038	27 0N 140 7E	PCN 3			PGTW
28	270545	27 6N 140 6E	PCN 3	T3 5/3 5-/D1 0/24HRS		PGTW
29	270545	27 5N 140 4E	PCN 3	T3 0/3 5 /W0 5/24HRS		RODN
30	270911	27 7N 140 5E	PCN 6			PGTW
31	271200	28 0N 140 2E	PCN 6			PGTW
32	271318	28 1N 139 6E	PCN 4			PGTW
33	271830	28 4N 138 4E	PCN 4	T4 0/4 0-/D0 5/24HRS		PGTW
34	272149	28 8N 137 9E	PCN 4			PGTW
35	280000	29 0N 137 6E	PCN 4			PGTW
36	280532	29 4N 136 2E	PCN 3	T4 0/4 0 /D1 0/24HRS		RODN
37	280533	29 3N 136 4E	PCN 3	T4 0/4 0-/D0 5/24HRS		PGTW
38	280959	29 4N 136 0E	PCN 1			PGTW
39	281258	29 5N 135 4E	PCN 2			PGTW
40	281800	29 6N 134 1E	PCN 2	T4 0/4 0-/S0 0/24HRS		PGTW
41	282357	29 9N 133 0E	PCN 1	T4 0/4 0	INIT OBS	RSKO
42	290000	29 3N 133 0E	PCN 2			PGTW
43	290139	29 7N 132 8E	PCN 1	T4 5/4 5 /D0 5/20HRS		RODN
44	290600	29 8N 131 7E	PCN 2	T4 0/4 0 /S0 0/24HRS		PGTW
45	290702	29 7N 131 8E	PCN 1			RSKO
46	290938	29 9N 131 2E	PCN 3	T5 0/5 0	INIT OBS EYE DIA 30NM	RPMK
47	291004	29 6N 131 1E	PCN 1			RSKO
48	291200	29 6N 130 8E	PCN 2	T5 0/5 0 /D1 0 18HRS		PGTW
49	291419	29 4N 130 6E	PCN 1		CIRCULAR EYE	RPMK
50	291847	30 3N 129 0E	PCN 1			RPMK
51	292036	30 0N 128 8E	PCN 1			RSKO
52	292242	30 2N 128 6E	PCN 1	T5 0/5 0 /D1 0/24HRS	12NM EYE	RSKO
53	300000	30 3N 128 4E	PCN 2			PGTW
54	300118	30 7N 128 2E	PCN 1	T4 5/5 0 /W0 5/16HRS		RPMK
55	300600	31 3N 126 4E	PCN 2	T5 0/5 0-/D1 0/24HRS		PGTW
56	300650	31 0N 126 7E	PCN 1			RSKO
57	300900	31 1N 125 7E	PCN 4			PGTW
58	300940	31 6N 125 7E	PCN 6			RPMK
59	301058	31 3N 125 5E	PCN 3			RSKO
60	301200	31 1N 125 3E	PCN 4			PGTW
61	301359	31 5N 124 6E	PCN 3			PGTW
62	301359	31 3N 124 8E	PCN 5			RPMK
63	301935	31 5N 123 2E	PCN 5	T3 5/4 5-/W1 5/30HRS		PGTW
64	302359	31 8N 123 0E	PCN 3	T4 0/4 5-/W0 5/23HRS		RPMK
65	310050	31 8N 122 6E	PCN 3			PGTW
66	310637	32 2N 121 7E	PCN 4			PGTW
67	311036	32 5N 122 0E	PCN 1	T4 0/5 0-/W1 0/09HRS	ULCC FIX	RSKO
68	311520	32 8N 121 0E	PCN 6		ULCC FIX	RPMK
69	312335	33 0N 120 9E	PCN 3	T2 5/3 5-/W1 5/23HRS		RSKO
70	312335	33 1N 120 6E	PCN 3	T4 0/4 0	INIT OBS	RODN
71	010000	[illegible] 120 [illegible]	PCN 4			PGTW
72	010018	[illegible] 120 3E	PCN 4			PGTW

73	010014	[illegible] 4N 120 8E	PCN [illegible]	T4 0/4 0	INIT OBS	RODN
74	010600	33 7N 120 3E	PCN 4			PGTU
75	010628	33 7N 120 7E	PCN 3			RSFO
76	011015	33 8N 120 1E	PCN 4			PGTU
77	011032	33 9N 119 9E	PCN 3		ULCC FIX	RSFO
78	011459	33 8N 120 6E	PCN 4			RPMK
79	020159	34 8N 119 6E	PCN 3	T2 5/2 5	INIT OBS	RPMK
80	020159	34 7N 119 8E	PCN 3			RODN
81	020600	35 0N 119 6E	PCN 4		EXP LLCC	PGTU
82	020616	35 1N 120 2E	PCN 3			RSFO

AIRCRAFT FIXES

FIX NO	TIME (Z)	FIX POSITION	FLT LVL	700MB HGT	OBS MSLP	MAX-SFC-WND VEL/BRG/RNG	MAX-FLT-LVL-WND DIR/VEL/BRG/RNG	ACCRY NAV/MET	EYE SHAPE	EYE ORIEN-DIAM/TATION	EYE TEMP (C) OUT/ IN/ DP/SST	MSN NO
1	252219	26 2N 137 2E	1500FT		985	70 220 15	320 53 220 15	8 2	CIRCULAR	20	+26 +27 +23 30	1
2	260618	25 7N 139 0E	700MB	2984		50 140 25	250 53 140 39	12 3				2
3	260844	25 7N 139 5E	700MB	2983	986	25 270 10	010 30 330 54	12 4	ELLIPTICAL	18 10 090	+11 +14 +10	2
4	262218	26 9N 140 6E	700MB	2937		40 200 40	250 45 200 40					3
5	262341	26 9N 140 8E	700MB	2930	982	40 090 60	190 56 090 30	10 10	CIRCULAR	30	+12 +14 +11	3
6	270830	27 9N 140 1E	1500FT		976	40 210 34	200 60 110 20	3 3				4
7	271116	28 2N 139 6E	700MB	2888	974		110 61 040 45	8 5			+13 +17 +10	4
8	272038	28 8N 138 5E	700MB	2858		50 100 20	050 57 310 74	12 3				5
9	272324	28 9N 137 9E	700MB	2867	976	50 050 50	300 71 180 25	12 2			+12 +16	5
10	280837	29 3N 136 1E	700MB	2842	967	70 130 34	140 63 130 34	7 3	CIRCULAR	20		6
11	281112	29 6N 135 6E	700MB	2840			100 70 320 108	5 5	ELLIPTICAL	25 20 170	+13 +15 +12	6
12	282029	29 9N 133 3E	700MB	2806		65 310 12	140 92 050 24	4 2				7
13	282320	29 8N 133 0E	700MB	2818	968	65 120 40	200 67 140 19	10 4	ELLIPTICAL	35 25 050	+12 +15	7
14	290835	29 8N 131 6E	700MB	2622	945	100 050 15	120 84 050 15	5 7	ELLIPTICAL	25 20 320	+13 +17 +13	8
15	291114	29 8N 130 9E	700MB	2675	949		310 73 230 25	6 7	CIRCULAR	20	+14 +19 +12	8
16	292030	30 1N 129 3E	700MB	2658	947	90 240 60	330 80 250 20	6 5	CIRCULAR	20	+12 +17 +13	9
17	292321	30 4N 128 4E	700MB	2693	953	110 150 10	140 87 010 30	4 1	CIRCULAR	20	+12 +19 +12	9
18	300302	31 2N 123 0E	700MB	2734	958	65 030 42	130 87 050 28	10 2	CIRCULAR	15	+11 +17	10
19	301136	31 3N 125 2E	700MB	2771	965		150 87 070 33	10 2	CIRCULAR	20	+13 +16	10

RADAR FIXES

FIX NO	TIME (Z)	FIX POSITION	RADAR	ACCRY	EYE SHAPE	EYE DIAM	RADOB-CODE ASWAR TDDFF	COMMENTS	RADAR POSITION	SITE WMO NO
1	290000	29 7N 132 7E	LAND				10712 52411		28 4N 129 5E	47909
2	290100	29 7N 132 5E	LAND				10712 52711		28 4N 129 5E	47909
3	290100	29 7N 132 5E	LAND				10771 52611		30 6N :31 0E	47869
4	290200	29 8N 132 4E	LAND				10713 52911		28 4N 129 5E	47909
5	290200	29 7N 132 3E	LAND				10711 52711		30 6N 131 0E	47869
6	290300	29 8N 132 2E	LAND				10712 52711		28 4N 129 5E	47909
7	290300	29 7N 132 3E	LAND				10711 52711		30 6N 131 0E	47869
8	290300	29 8N 132 4E	LAND	POOR		37		VMNT 3120	31 4N 131 3E	69952
9	290400	29 6N 132 0E	LAND				10612 52611		30 6N 131 0E	47869
10	290400	29 8N 132 2E	LAND	POOR		35		VMNT 3120	31 7N 129 8E	69956
11	290400	29 7N 132 1E	LAND				10712 52611		28 4N 129 5E	47909
12	290500	29 7N 131 9E	LAND				10712 52711		28 4N 129 5E	47909
13	290500	29 7N 131 8E	LAND				10612 52708		30 6N 131 0E	47869
14	290500	29 7N 132 0E	LAND	POOR		35		VMNT 2720	31 4N 131 3E	69952
15	290600	29 7N 131 7E	LAND				10612 52708		30 6N 131 0E	47869
16	290600	29 7N 131 8E	LAND				10812 52705		28 4N 129 5E	47909
17	290700	29 7N 131 6E	LAND				10612 52708		30 6N 131 0E	47869
18	290700	29 7N 131 6E	LAND				10712 52708		28 4N 129 5E	47909
19	290700	29 7N 131 7E	LAND	GOOD		30		VMNT 2715	31 4N 131 3E	69952
20	290800	29 7N 131 6E	LAND				10712 52703		28 4N 129 5E	47909
21	290800	29 7N 131 4E	LAND				10612 52708		30 6N 131 0E	47869
22	290800	29 7N 131 5E	LAND	GOOD		30		VMNT 2710	31 4N 131 3E	69952
23	290900	29 7N 131 3E	LAND				10522 52705		30 6N 131 0E	47869
24	290900	29 7N 131 4E	LAND				10712 52711		28 4N 129 5E	47909
25	291000	29 8N 131 1E	LAND				10512 52811		30 6N 131 0E	47869
26	291000	29 8N 131 2E	LAND				10712 53011		28 4N 129 5E	47909
27	291000	29 8N 131 2E	LAND	GOOD				VMNT 2910	31 4N 131 3E	69952
28	291100	29 8N 131 0E	LAND				10712 52811		28 4N 129 5E	47909
29	291100	29 8N 130 9E	LAND				10512 52711		30 6N 131 0E	47869
30	291100	29 8N 131 0E	LAND	GOOD		30		VMNT 2810	31 4N 131 3E	69952
31	291200	29 8N 130 7E	LAND				10512 52711		30 6N 131 0E	47869
32	291200	29 8N 130 8E	LAND				10712 52711		28 4N 129 5E	47909
33	291200	29 8N 130 8E	LAND	GOOD		25		VMNT 2712	31 4N 131 3E	69952
34	291300	29 8N 130 5E	LAND				10712 52813		28 4N 129 5E	47909
35	291300	29 8N 130 4E	LAND				10612 52716		30 6N 131 0E	47869
36	291300	29 8N 130 5E	LAND	GOOD		35		VMNT 2825	31 4N 131 3E	69952
37	291400	29 8N 130 3E	LAND				10513 52811		30 6N 131 0E	47869
38	291400	29 8N 130 3E	LAND				10712 52711		28 4N 129 5E	47909
39	291400	29 8N 130 3E	LAND	GOOD		35		VMNT 2722	31 4N 131 3E	69952
40	291500	29 9N 130 1E	LAND				10712 52811		28 4N 129 5E	47909
41	291500	29 9N 130 1E	LAND				10513 52811		30 6N 131 0E	47869
42	291500	29 9N 130 1E	LAND	GOOD		35		VMNT 2818	31 4N 131 3E	69952
43	291600	30 0N 129 9E	LAND				10513 52911		30 6N 131 0E	47869
44	291600	29 9N 130 0E	LAND				10712 53007		28 4N 129 5E	47909
45	291600	29 9N 130 0E	LAND	GOOD		35		VMNT 2918	31 4N 131 3E	69952
46	291700	29 9N 130 0E	LAND				10712 53011		28 4N 129 5E	47909
47	291700	30 1N 129 7E	LAND				10613 52911		30 6N 131 0E	47869
48	291700	30 1N 129 8E	LAND	GOOD		30		VMNT 3225	31 4N 131 3E	69952
49	291800	30 2N 129 5E	LAND				10613 52911		30 6N 131 0E	47869
50	291800	30 2N 129 5E	LAND				10612 53016		28 4N 129 5E	47909
51	291800	30 2N 129 5E	LAND	GOOD		30		VMNT 3130	31 4N 131 3E	69952
52	291900	30 2N 129 2E	LAND				10612 53011		28 4N 129 5E	47909
53	291900	30 3N 129 3E	LAND				10613 53011		30 6N 131 0E	47869
* 54	291900	30 8N 129 8E	LAND	GOOD		30		MVMNT 3015	31 4N 131 3E	69952
55	292000	30 2N 129 0E	LAND				10612 52814		30 6N 131 0E	47869
56	292000	30 3N 129 0E	LAND				10612 52711		28 4N 129 5E	47909
57	292000	29 2N 129 0E	LAND	GOOD		30		VMNT 2720	31 4N 131 3E	69952
58	292100	30 2N 128 9E	LAND				10512 52705		28 4N 129 5E	47909
59	292100	30 3N 128 9E	LAND				10612 52811		30 6N 131 0E	47869
60	292200	30 3N 128 7E	LAND				10512 53213		28 4N 129 5E	47909
61	292200	30 4N 128 7E	LAND				10612 53011		30 6N 131 0E	47869
62	292300	30 4N 128 5E	LAND				10862 52913		28 4N 129 5E	47909
63	292300	30 5N 128 4E	LAND				10612 53011		30 6N 131 0E	47869
64	300000	30 6N 128 2E	LAND				10342 53116		28 4N 129 5E	47909
65	300000	30 6N 128 3E	LAND				55//2 52911		30 6N 131 0E	47869
66	300100	30 6N 128 1E	LAND				65//2 52911		30 6N 131 0E	47869
67	300100	30 7N 128 0E	LAND				20513 53014		28 4N 129 5E	47909
68	300100	30 7N 128 1E	LAND	GOOD		30		VMNT 3120	31 7N 129 8E	69956
69	300200	30 8N 127 8E	LAND	GOOD		35		VMNT 3110	31 7N 129 8E	69956
70	300200	30 8N 127 7E	LAND				20633 53016		28 4N 129 5E	47909
71	300300	31 0N 127 3E	LAND				35/// 53027		28 4N 129 5E	47909
72	300400	30 8N 127 3E	LAND	GOOD		35		VMNT 3010	31 7N 129 8E	69956
73	300400	30 9N 127 1E	LAND				35/// 52511		28 4N 129 5E	47909
74	300500	30 8N 127 0E	LAND	POOR		35		VMNT 2710	31 7N 129 8E	69956
75	300500	31 0N 126 9E	LAND				35/// 53011		28 4N 129 5E	47909
76	300600	31 1N 126 5E	LAND				65/// 52922		28 4N 129 5E	47909
77	300700	31 0N 126 6E	LAND	GOOD		35		VMNT 2910	31 7N 129 8E	69956
78	301100	31 2N 125 8E	LAND				6///2 32812		31 2N 121 4E	58369
79	301400	31 3N 124 8E	LAND				5///2 72815		31 2N 121 4E	58369
* 80	301700	32 5N 123 8E	LAND				5///2 72815		31 2N 121 4E	58369
81	302300	31 8N 122 8E	LAND				4///2 62910		31 2N 121 4E	58369
82	310000	31 8N 122 6E	LAND				4///2 52910		31 2N 121 4E	58369
83	310100	31 9N 122 5E	LAND				4///2 52910		31 2N 121 4E	56369
84	310200	32 1N 122 4E	LAND				5///2 73110		31 2N 121 4E	58369
85	310300	32 2N 121 9E	LAND				24873 52921		33 8N 120 3E	58151
86	310300	32 2N 122 3E	LAND				5///2 53110		31 2N 121 4E	58369
87	310400	32 3N 121 8E	LAND				34842 52914		33 8N 120 3E	58151
88	310400	32 3N 122 2E	LAND				6///2 53110		31 2N 121 4E	58369
89	310500	32 3N 121 7E	LAND				22743 53012		33 8N 120 3E	58151
90	310500	32 3N 122 1E	LAND				5///2 73108		31 2N 121 4E	58369
91	310600	32 3N 121 7E	LAND				32743 53112		33 8N 120 3E	58151
92	310700	32 4N 121 7E	LAND				30412 53012		33 8N 120 3E	58151
93	310800	32 5N 121 6E	LAND				30713 53010		33 8N 120 3E	58151
94	310800	32 4N 121 7E	LAND				5///2 72809		31 2N 121 4E	58369
95	310900	32 4N 121 6E	LAND				113/2 52710		31 2N 121 4E	58369
96	311000	32 4N 121 4E	LAND				11312 52705		31 2N 212 4E	58369
97	311100	32 4N 121 5E	LAND				2//62 50000		31 2N 121 4E	58369
98	311200	32 4N 121 4E	LAND				2///2 52706		31 2N 121 4E	58369
99	311400	32 4N 121 2E	LAND				5///2 72706		31 2N 121 4E	58369

100	311700	32 8N 120 7E	LAND	30541	52805	33.8N 120 3E	58151
101	311900	32 8N 120 9E	LAND	20521	50000	33.8N 120 3E	58151
*102	312000	33 0N 120.7E	LAND	31452	53213	33.8N 120.3E	58151

NOTICE - THE ASTERISKS (*) INDICATE FIXES UNREPRESENTATIVE AND NOT USED FOR BEST TRACK PURPOSES.

TROPICAL STORM FREDA
BEST TRACK DATA

	BEST TRACK		WARNING		ERRORS		24 HOUR FORECAST		ERRORS		48 HOUR FORECAST		ERRORS		72 HOUR FORECAST		ERRORS	
MO/DA/HR	POSIT	WIND	POSIT	WIND	DST	WIND	POSIT	WIND	DST	WIND	POSIT	WIND	DST	WIND	POSIT	WIND	DST	WIND
080400Z	11.3 132.4	20	0.0 0.0	0.	-0.	0.	0.0 0.0	0.	-0.	0.	0.0 0.0	0.	-0.	0.	0.0 0.0	0.	-0.	0.
080406Z	12.2 131.5	20	0.0 0.0	0.	-0.	0.	0.0 0.0	0.	-0.	0.	0.0 0.0	0.	-0.	0.	0.0 0.0	0.	-0.	0.
080412Z	13.7 130.6	20	0.0 0.0	0.	-0.	0.	0.0 0.0	0.	-0.	0.	0.0 0.0	0.	-0.	0.	0.0 0.0	0.	-0.	0.
080418Z	14.9 129.6	25	0.0 0.0	0.	-0.	0.	0.0 0.0	0.	-0.	0.	0.0 0.0	0.	-0.	0.	0.0 0.0	0.	-0.	0.
080500Z	15.8 128.3	25	0.0 0.0	0.	-0.	0.	0.0 0.0	0.	-0.	0.	0.0 0.0	0.	-0.	0.	0.0 0.0	0.	-0.	0.
080506Z	16.9 127.2	30	0.0 0.0	0.	-0.	0.	0.0 0.0	0.	-0.	0.	0.0 0.0	0.	-0.	0.	0.0 0.0	0.	-0.	0.
080512Z	18.0 126.8	30	17.8 126.3	30.	31.	0.	19.2 124.6	45	141.	0	21.3 122.5	65.	310.	10.	24.0 120.6	75.	408.	50.
080518Z	18.9 126.2	35	18.8 126.2	30.	6.	-5.	20.6 124.5	50.	144.	5	22.7 122.5	70.	308.	25.	25.1 120.9	75.	432.	55.
080600Z	19.7 125.8	40	20.0 126.1	40.	25.	0	24.0 125.3	55.	117.	0.	27.9 124.6	70.	323.	30.	31.8 126.0	85.	514.	65.
080606Z	20.4 125.5	40	20.4 125.3	45.	11.	5.	24.0 124.4	60.	180.	10.	27.6 123.8	75.	329.	45.	31.2 124.5	90.	481.	70.
080612Z	21.5 125.1	45	23.0 125.5	45.	93.	0.	26.0 124.6	65.	226.	10.	29.6 124.4	80.	386.	55.	33.5 125.4	80.	520.	60.
080618Z	23.0 124.6	45	23.6 124.8	50.	38.	5.	26.3 123.2	70.	208.	25.	29.9 122.3	80.	313.	60.	34.3 122.0	70.	332.	50.
080700Z	24.4 123.2	55	24.3 123.3	50.	8.	-5	28.2 121.6	65.	165.	25.	32.2 121.8	45.	300.	25.	0.0 0.0	0.	-0.	0.
080706Z	25.0 121.3	50	25.0 121.9	50.	33.	0	28.3 121.0	50.	175.	20.	32.2 122.2	40.	351.	20	0.0 0.0	0.	-0.	0.
080712Z	26.1 120.4	55	25.8 121.1	50.	42.	-5.	28.9 118.8	25.	115.	0.	0.0 0.0	0.	-0.	0.	0.0 0.0	0.	-0.	0.
080718Z	27.0 119.4	45	26.6 119.7	45.	29.	0.	0.0 0.0	0.	-0.	0.	0.0 0.0	0.	-0.	0.	0.0 0.0	0.	-0.	0.
080800Z	28.0 118.5	40	28.2 119.0	40.	29.	0.	0.0 0.0	0.	-0.	0.	0.0 0.0	0.	-0.	0.	0.0 0.0	0.	-0.	0.
080806Z	29.1 117.8	30	29.0 118.2	30.	22.	0.	0.0 0.0	0.	-0.	0.	0.0 0.0	0.	-0.	0.	0.0 0.0	0.	-0.	0.
080812Z	30.0 117.0	25	0.0 0.0	0.	-0.	0.	0.0 0.0	0.	-0.	0.	0.0 0.0	0.	-0.	0.	0.0 0.0	0.	-0.	0.
080818Z	31.1 116.4	20	0.0 0.0	0.	-0.	0.	0.0 0.0	0.	-0.	0.	0.0 0.0	0.	-0.	0.	0.0 0.0	0.	-0.	0.
080900Z	32.2 115.9	20	0.0 0.0	0.	-0.	0.	0.0 0.0	0.	-0.	0.	0.0 0.0	0.	-0.	0.	0.0 0.0	0.	-0.	0.
080906Z	33.5 115.4	20	0.0 0.0	0.	-0.	0.	0.0 0.0	0.	-0.	0.	0.0 0.0	0.	-0.	0.	0.0 0.0	0.	-0.	0.
080912Z	35.2 115.1	20	0.0 0.0	0.	-0.	0.	0.0 0.0	0.	-0.	0.	0.0 0.0	0.	-0.	0.	0.0 0.0	0.	-0.	0.
080918Z	36.9 116.0	20	0.0 0.0	0.	-0.	0.	0.0 0.0	0.	-0.	0.	0.0 0.0	0.	-0.	0.	0.0 0.0	0.	-0.	0.

	ALL FORECASTS				TYPHOONS WHILE OVER 35 KTS			
	WRNG	24-HR	48-HR	72-HR	WRNG	24-HR	48-HR	72-HR
AVG FORECAST POSIT ERROR	30.	163.	328.	448.	0	0.	0.	0.
AVG RIGHT ANGLE ERROR	20.	81.	218.	283.	0.	0.	0.	0.
AVG INTENSITY MAGNITUDE ERROR	2.	11.	34.	58.	0.	0.	0.	0.
AVG INTENSITY BIAS	-0.	11.	34.	58.	0.	0.	0.	0.
NUMBER OF FORECASTS	12	9	8	6	0	0	0	0

DISTANCE TRAVELED BY TROPICAL CYCLONE IS 1894. NM

AVERAGE SPEED OF TROPICAL CYCLONE IS 14. KNOTS

TROPICAL STORM FREDA
FIX POSITIONS FOR CYCLONE NO. 8

SATELLITE FIXES

FIX NO.	TIME (Z)	FIX POSITION	ACCRY	DVORAK CODE	COMMENTS	SITE
* 1	040000	12.7N 133.7E	PCN 6	T1.0/1.0	INIT OBS	PGTW
* 2	040729	11.4N 132.0E	PCN 5			PGTW
* 3	040912	11.4N 130.6E	PCN 6			PGTW
* 4	041101	11.4N 131.7E	PCN 6			PGTW
* 5	041359	13.0N 131.5E	PCN 6	T1.5/1.5	INIT OBS	PGTW
6	042152	15.8N 129.5E	PCN 6		ULCC FIX	PGTW
7	050058	15.4N 127.4E	PCN 5			PGTW
8	050717	16.8N 126.2E	PCN 5	T2.0/2.0 /D1.0/31HRS		PGTW
9	051036	17.8N 126.7E	PCN 5			PGTW
10	051200	17.8N 126.4E	PCN 6			PGTW
11	051339	18.6N 126.8E	PCN 5			PGTW
12	051800	19.1N 126.5E	PCN 6	T2.5/2.5 /D1.0/28HRS		PGTW
13	052001	19.2N 126.2E	PCN 6			PGTW
14	052001	19.7N 126.2E	PCN 6			RODN
15	052131	19.4N 125.9E	PCN 5			PGTW
* 16	060038	21.3N 128.7E	PCN 5			PGTW
17	060220	20.2N 125.6E	PCN 5	T3.0/3.0	INIT OBS	RPMK
18	060704	20.4N 125.1E	PCN 6	T2.5/2.5 /D0.5/24HRS		PGTW
19	060704	20.1N 125.5E	PCN 5			RPMK
* 20	061010	23.3N 125.8E	PCN 3			PGTW
* 21	061200	23.1N 125.6E	PCN 6			PGTW
* 22	061500	23.7N 124.2E	PCN 4			RODN
23	061800	23.3N 124.5E	PCN 6			PGTW
24	062109	24.3N 123.1E	PCN 6	T3.0/3.0 /D0.5/27HRS		PGTW
25	062251	24.3N 123.2E	PCN 3			PGTW
26	070000	24.4N 122.8E	PCN 6			PGTW
27	070159	25.3N 122.4E	PCN 5	T3.5/3.5 /D0.5/24HRS		RPMK
28	070652	25.3N 121.1E	PCN 6	T3.0/3.0-/D0.5/24HRS		PGTW
29	070949	25.5N 121.2E	PCN 6			PGTW
* 30	071129	25.4N 121.2E	PCN 4			RODN
31	071129	26.0N 121.2E	PCN 3			RPMK
32	071440	26.2N 119.9E	PCN 3			RPMK
33	071800	26.9N 119.3E	PCN 6			PGTW
34	071936	27.5N 118.8E	PCN 5			PGTW
35	072229	28.7N 118.5E	PCN 5		ULCC FIX	RODN
36	080000	28.9N 118.2E	PCN 5		ULCC FIX	RODN
37	080000	28.2N 118.8E	PCN 6		ULCC FIX	PGTW
38	080008	27.4N 118.4E	PCN 5		ULCC FIX	RPMK
39	080600	29.0N 117.9E	PCN 6		ULCC FIX	PGTW

AIRCRAFT FIXES

FIX NO	TIME (Z)	FIX POSITION	FLT LVL	700MB HGT	OBS MSLP	MAX-SFC-WND VEL/BRG/RNG	MAX-FLT-LVL-WND DIR/VEL/BRG/RNG	ACCRY NAV/MET	EYE SHAPE	EYE DIAM/ORIEN-TATION	EYE TEMP (C) OUT/ IN/ DP/SST	MSN NO
1	032240	11.0N 132.7E	1500FT		1005	25 260 35	060 30 330 110	4 10			+25 +25 32	2
2	060207	19.7N 125.4E	1500FT		993	50 160 125	270 47 160 150	3 1	CIRCULAR	20	+27 +25 33	5
3	06 541	20.2N 125.5E	1500FT		991	40 130 120	220 36 130 30	13 10				6
* 4	06 313	20.1N 125.4E	1500FT		989	35 040 122	010 28 310 30	10 10			+26 +26	6
5	070019	24.3N 123.0E	1500FT		988	45 100 55	170 45 100 55	1 5			+26 +25 +25	7

RADAR FIXES

FIX NO	TIME (Z)	FIX POSITION	RADAR	ACCRY	EYE SHAPE	EYE DIAM	RADOB-CODE ASWAR TDDFF	COMMENTS	RADAR POSITION	SITE WMO NO.
* 1	061700	21.6N 124.8E	LAND				3//13 53619		24.3N 124.2E	47918
* 2	061800	22.2N 124.8E					6//13 53632		24.3N 124.2E	47918
3	061900	23.0N 124.7E	LAND				6//13 53554		24.3N 124.2E	47918
4	062000	23.5N 124.4E	LAND				6//13 53432		24.3N 124.2E	47918
* 5	062200	23.4N 123.9E					6///2 53227		24.3N 124.2E	47918
6	062200	24.2N 124.1E	LAND				65//4 53138		24.8N 125.3E	47927
7	070000	24.7N 122.9E	LAND				6//12 52938		24.3N 124.2E	47918
8	070000	24.6N 122.8E	LAND				35//4 5////		24.8N 125.3E	47927
9	070100	24.8N 122.6E	LAND				6//12 72924		24.3N 124.2E	47918
10	070200	24.9N 122.2E	LAND				6//12 72927		24.3N 124.2E	47918
11	070200	24.7N 122.3E	LAND				35//3 52919		24.8N 125.3E	47927
* 12	070500	25.0N 120.8E					34574 53012		27.6N 121.1E	58760

NOTICE - THE ASTERISKS (*) INDICATE FIXES UNREPRESENTATIVE AND NOT USED FOR BEST TRACK PURPOSES

TROPICAL DEPRESSION 09
BEST TRACK DATA

MO/DA/HR	BEST TRACK POSIT	BEST TRACK WIND	WARNING POSIT	WARNING WIND	WARNING ERRORS DST	WARNING ERRORS WIND	24 HOUR FORECAST POSIT	24 HOUR FORECAST WIND	24 HOUR ERRORS DST	24 HOUR ERRORS WIND	48 HOUR FORECAST POSIT	48 HOUR FORECAST WIND	48 HOUR ERRORS DST	48 HOUR ERRORS WIND	72 HOUR FORECAST POSIT	72 HOUR FORECAST WIND	72 HOUR ERRORS DST	72 HOUR ERRORS WIND
080912Z	9.4 133.6	20	0.0 0.0	0	-0.	0	0.0 0.0	0.	-0.	0.	0.0 0.0	0	-0.	0	0.0 0.0	0.	-0.	0.
080918Z	9.9 131.5	20	0.0 0.0	0	-0.	0	0.0 0.0	0.	-0.	0.	0.0 0.0	0	-0.	0	0.0 0.0	0.	-0.	0.
081000Z	10.7 130.2	20	0.0 0.0	0	-0.	0	0.0 0.0	0.	-0.	0.	0.0 0.0	0	-0.	0	0.0 0.0	0.	-0.	0.
081006Z	11.9 129.5	20	0.0 0.0	0	-0.	0	0.0 0.0	0.	-0.	0.	0.0 0.0	0	-0.	0	0.0 0.0	0.	-0.	0.
081012Z	13.4 129.6	20	0.0 0.0	0	-0.	0	0.0 0.0	0.	-0.	0.	0.0 0.0	0	-0.	0	0.0 0.0	0.	-0.	0.
081018Z	14.9 129.9	20	0.0 0.0	0	-0.	0	0.0 0.0	0.	-0.	0.	0.0 0.0	0	-0.	0	0.0 0.0	0.	-0.	0.
081100Z	16.0 129.9	25	0.0 0.0	0	-0.	0	0.0 0.0	0.	-0.	0.	0.0 0.0	0	-0.	0	0.0 0.0	0.	-0.	0.
081106Z	17.1 129.6	25	0.0 0.0	0	-0.	0	0.0 0.0	0.	-0.	0.	0.0 0.0	0	-0.	0	0.0 0.0	0.	-0.	0.
081112Z	17.9 129.2	30	18.3 129.3	25	25.	-5	21.5 127.1	45.	111.	15.	24.8 123.3	60.	354.	30.	0.0 0.0	0.	-0.	0.
081118Z	18.6 128.6	30	19.3 129.0	30	48.	0	22.7 126.4	50.	169.	20.	26.1 122.7	60.	486.	35.	0.0 0.0	0.	-0.	0.
081200Z	19.2 127.8	30	20.2 127.8	25	60.	-5	23.4 124.5	35.	193.	5.	0.0 0.0	0.	-0.	0.	0.0 0.0	0.	-0.	0.
081206Z	19.7 127.0	30	21.8 126.5	30	129.	0	26.2 123.0	45.	368.	15.	0.0 0.0	0.	-0.	0.	0.0 0.0	0.	-0.	0.
081212Z	20.2 125.7	30	22.2 126.3	30	125.	0	26.5 123.2	45.	442.	15.	0.0 0.0	0.	-0.	0.	0.0 0.0	0.	-0.	0.
081218Z	20.5 124.5	30	22.6 125.2	30	132.	0	26.5 122.4	45.	501.	20.	0.0 0.0	0.	-0.	0.	0.0 0.0	0.	-0.	0.
081300Z	20.5 123.0	30	23.0 123.3	30	151.	0.	0.0 0.0	0.	-0.	0.	0.0 0.0	0.	-0.	0.	0.0 0.0	0.	-0.	0.
081306Z	20.2 121.6	30	22.8 121.9	30	157.	0.	0.0 0.0	0.	-0.	0.	0.0 0.0	0.	-0.	0.	0.0 0.0	0.	-0.	0.
081312Z	19.7 120.1	30	22.4 120.9	30	168.	0.	0.0 0.0	0.	-0.	0.	0.0 0.0	0.	-0.	0.	0.0 0.0	0.	-0.	0.
081318Z	18.8 118.9	25	22.3 120.5	30.	228.	5.	0.0 0.0	0.	-0.	0.	0.0 0.0	0.	-0.	0.	0.0 0.0	0.	-0.	0.

	ALL FORECASTS WRNG	24-HR	48-HR	72-HR	TYPHOONS WHILE OVER 35 KTS WRNG	24-HR	48-HR	72-HR
AVG FORECAST POSIT ERROR	122.	297.	420.	0.	0.	0.	0.	0.
AVG RIGHT ANGLE ERROR	105.	248.	296.	0.	0.	0.	0.	0.
AVG INTENSITY MAGNITUDE ERROR	2.	15.	33.	0.	0.	0.	0.	0.
AVG INTENSITY BIAS	-1.	15.	33.	0.	0.	0.	0.	0.
NUMBER OF FORECASTS	10	6	2	0	0	0	0	0

DISTANCE TRAVELED BY TROPICAL CYCLONE IS 1328. NM

AVERAGE SPEED OF TROPICAL CYCLONE IS 13. KNOTS

TROPICAL DEPRESSION TD09W
FIX POSITIONS FOR CYCLONE NO. 9

SATELLITE FIXES

FIX NO	TIME (Z)	FIX POSITION	ACCRY	DVORAK CODE	COMMENTS	SITE
1	050000	7.8N 147.2E	PCN 6	T0.5/0.5	INIT OBS	PGTW
2	072048	6.4N 139.4E	PCN 5	T1.0/1.0	INIT OBS	PGTW
3	080139	8.8N 138.2E	PCN 5			PGTW
4	080639	8.6N 139.4E	PCN 6		ULCC FIX	PGTW
5	081238	8.3N 134.4E	PCN 5			PGTW
6	082202	7.6N 136.8E	PCN 5	T1.0/1.0+/S0.0/25HRS		PGTW
7	090626	9.4N 135.6E	PCN 6			PGTW
8	091200	8.9N 133.7E	PCN 6			PGTW
9	091400	9.2N 133.4E	PCN 6			PGTW
10	091911	10.1N 130.7E	PCN 6	T1.0/1.0+/S0.0/24HRS	EXP LLCC	PGTW
11	092147	10.7N 129.6E	PCN 6			PGTW
12	100058	11.0N 129.4E	PCN 5		ULCC FIX	PGTW
13	100614	12.0N 128.4E	PCN 6	T0.0/0.0	INIT OCS ULCC FIX	PGTW
14	101339	13.7N 130.4E	PCN 6			PGTW
15	101859	15.5N 129.1E	PCN 6	T1.0/1.0+/S0.0/24HRS		PGTW
16	102255	15.6N 130.4E	PCN 5			PGTW
17	102255	15.5N 130.9E	PCN 5	T1.0/1.0	INIT OBS	RPMK
18	110039	15.1N 130.2E	PCN 5			PGTW
19	110600	17.6N 129.9E	PCN 6	T1.5/1.5 /D1.5/24HRS		PGTW
20	110743	17.5N 129.1E	PCN 5	T1.0/1.0	INIT OBS	RODN
21	111006	18.0N 129.9E	PCN 6			PGTW
22	111200	18.4N 130.0E	PCN 6		ULCC FIX	PGTW
23	111319	18.5N 130.2E	PCN 6		ULCC FIX	PGTW
* 24	111800	19.4N 129.4E	PCN 6	T2.5/2.5-/D1.5/23HRS	EXP LLCC	PGTW
25	111846	19.5N 129.2E	PCN 6			PGTW
* 26	112104	19.6N 129.2E	PCN 6			PGTW
* 27	112230	20.2N 128.8E	PCN 5			PGTW
* 28	120000	20.5N 127.2E	PCN 6			PGTW
* 29	120200	20.8N 127.2E	PCN 5			PGTW
* 30	120600	22.1N 126.6E	PCN 5			PGTW
* 31	120731	21.2N 128.4E	PCN 5	T2.0/2.0 /D1.0/33HRS		RPMK
* 32	120731	22.1N 126.3E	PCN 5	T1.5/1.5+/S0.0/25HRS		PGTW
* 33	120944	22.1N 126.1E	PCN 5			PGTW
34	121109	21.2N 126.6E	PCN 5		ULCC FIX	RPMK
35	121109	21.1N 126.6E	PCN 6			RSKO
* 36	121200	22.1N 126.2E	PCN 6			PGTW
* 37	121440	22.0N 126.2E	PCN 5			RPMK
* 38	121800	22.6N 124.9E	PCN 6	T1.0/1.5 /W0.5/11HRS		PGTW
39	122016	22.5N 123.7E	PCN 6			RODN
40	122225	23.3N 123.3E	PCN 6			RODN
* 41	122348	23.4N 122.8E	PCN 5	T1.0/1.0	INIT OBS	RODN
* 42	122348	23.0N 123.8E	PCN 5	T1.5/1.5	INIT OBS	RSKO
* 43	130140	22.9N 122.4E	PCN 5			PGTW
* 44	130718	22.7N 121.7E	PCN 5	T1.5/1.5-/S0.0/24HRS		PGTW
* 45	130718	23.0N 121.5E	PCN 5	T2.0/2.0 /S0.0/24HRS		RPMK
46	131045	23.0N 121.4E	PCN 5		ULCC FIX	PGTW
* 47	131104	23.5N 120.6E	PCN 6			RPMK
* 48	131105	23.5N 121.5E	PCN 6			RODN
49	131200	23.1N 121.6E	PCN 6			PGTW
50	131420	23.2N 121.2E	PCN 5			PGTW
51	131800	22.7N 121.0E	PCN 6	T1.0/1.0-/S0.0/24HRS		PGTW
52	132003	22.6N 120.6E	PCN 6			PGTW
53	132203	21.5N 120.5E	PCN 5			PGTW
54	132203	21.7N 120.6E	PCN 5	T2.5/2.5	INIT OBS	RODN
55	132323	21.9N 120.2E	PCN 5	T2.0/2.0-/D0.5/24HRS		RSKO
56	140119	21.8N 120.4E	PCN 6			PGTW
57	140706	22.8N 119.6E	PCN 6	T1.5/1.5-/S0.0/24HRS		PGTW
58	141043	23.3N 121.6E	PCN 5			RPMK
59	141200	23.2N 119.8E	PCN 6		ULCC 23.5N 121.4E	PGTW
60	141400	23.8N 120.9E	PCN 5		ULCC FIX	PGTW
61	141800	23.3N 119.2E	PCN 6	T0.0/0.0 /W1.0/24HRS		PGTW
62	142259	19.8N 118.5E	PCN 5			RODN
63	142259	24.3N 118.2E	PCN 5	T1.0/1.0	ULCC FIX	RPMK

AIRCRAFT FIXES

FIX NO	TIME (Z)	FIX POSITION	FLT LVL	700MB HGT	OBS MSLP	MAX-SFC-WND VEL/BRG/RNG	MAX-FLT-LVL-WND DIR/VEL/BRG/RNG	ACCRY NAV/MET	EYE SHAPE	EYE ORIEN-DIAM/TATION	EYE TEMP (C) OUT/ IN/ DP/SST	MSN NO.
1	110729	17.3N 129.5E	1500FT		1003	25 310 37	150 25 310 37	8 20			+26 +23 +22 29	3
* 2	120027	17.9N 126.6E	1500FT		1003	18 030 130	160 21 030 135	3 00			+25 +25 31	4

NOTICE - THE ASTERISKS (*) INDICATE FIXES UNREPRESENTATIVE AND NOT USED FOR BEST TRACK PURPOSES.

TROPICAL STORM GERALD BEST TRACK DATA

MO/DA/HR	BEST TRACK POSIT	BEST TRACK WIND	WARNING POSIT	WARNING WIND	WARNING ERRORS DST	WARNING ERRORS WIND	24 HOUR FORECAST POSIT	24 HOUR FORECAST WIND	24 HOUR ERRORS DST	24 HOUR ERRORS WIND	48 HOUR FORECAST POSIT	48 HOUR FORECAST WIND	48 HOUR ERRORS DST	48 HOUR ERRORS WIND	72 HOUR FORECAST POSIT	72 HOUR FORECAST WIND	72 HOUR ERRORS DST	72 HOUR ERRORS WIND
081512Z	19.2 119.1	30	0.0 0.0	0	-0	0	0.0 0.0	0	-0	0	0.0 0.0	0	-0	0	0.0 0.0	0	-0	0
081518Z	19.7 118.8	35	0.0 0.0	0	-0	0	0.0 0.0	0	-0	0	0.0 0.0	0	-0	0	0.0 0.0	0	-0	0
081600Z	20.0 118.3	40	20.0 118.4	40	6	0	21.7 117.3	55	207	5	23.0 115.8	45	277	-10	0.0 0.0	0	-0	0
081606Z	20.1 117.6	40	20.3 118.2	40	36	0	21.8 117.1	60	199	10	23.4 115.2	45	289	-10	0.0 0.0	0	-0	0
081612Z	19.7 116.7	45	20.2 117.9	45	74	0	21.1 116.8	55	166	5	22.8 114.9	55	273	0	0.0 0.0	0	-0	0
081618Z	19.0 116.1	45	20.3 116.8	45	87	0	20.8 114.7	55	148	0	21.6 112.6	55	204	0	22.3 110.6	30	215	-20
081700Z	18.4 116.2	50	18.5 116.2	50	6	0	18.5 116.2	50	85	-5	18.6 117.0	55	264	0	19.2 119.0	45	374	0
081706Z	18.6 116.2	50	18.5 116.2	50	6	0	18.5 116.2	50	120	-5	18.6 117.4	55	302	0	19.3 119.3	45	370	0
081712Z	18.5 115.8	50	18.5 116.3	50	28	0	18.5 116.3	50	171	-5	19.1 118.1	55	347	0	20.8 119.3	60	337	15
081718Z	18.4 115.3	55	18.6 116.0	50	42	-5	18.3 116.6	55	217	0	19.4 118.4	55	358	5	21.1 119.6	65	336	20
081800Z	18.5 114.7	55	18.4 114.9	55	13	0	18.3 113.6	55	69	0	18.3 112.3	60	72	15	18.4 111.0	65	280	25
081806Z	18.7 114.1	55	18.5 114.2	55	13	0	18.6 112.1	60	12	5	18.7 110.9	60	133	15	18.8 109.6	60	403	25
081812Z	18.5 113.3	55	18.9 113.1	55	27	0	20.5 111.2	50	117	-5	22.4 109.6	35	230	-10	0.0 0.0	0	-0	0
081818Z	18.2 112.8	55	19.2 112.6	55	61	0	20.8 110.7	50	134	0	22.6 109.1	35	260	-10	0.0 0.0	0	-0	0
081900Z	18.1 112.4	55	18.2 112.2	55	13	0	18.3 109.6	50	174	5	18.5 106.6	50	482	10	0.0 0.0	0	-0	0
081906Z	18.4 112.1	55	18.5 112.3	55	13	0	19.1 110.2	45	157	0	19.6 107.8	45	464	10	0.0 0.0	0	-0	0
081912Z	18.7 112.0	55	18.5 111.8	55	17	0	18.8 110.1	50	214	5	19.3 108.1	45	506	15	0.0 0.0	0	-0	0
081918Z	19.0 112.1	50	18.5 111.8	50	35	0	18.5 110.9	45	231	0	19.0 109.3	40	512	15	0.0 0.0	0	-0	0
082000Z	19.5 112.4	45	19.0 112.0	45	38	0	19.0 112.0	45	215	5	0.0 0.0	0	-0	0	0.0 0.0	0	-0	0
082006Z	20.0 112.8	45	20.0 112.8	40	0	-5	22.7 115.4	35	13	0	0.0 0.0	0	-0	0	0.0 0.0	0	-0	0
082012Z	20.7 113.3	45	20.9 113.4	45	13	0	24.3 116.1	30	33	0	0.0 0.0	0	-0	0	0.0 0.0	0	-0	0
082018Z	21.4 113.6	45	21.5 113.6	40	6	-5	25.0 114.8	20	40	-5	0.0 0.0	0	-0	0	0.0 0.0	0	-0	0
082100Z	21.8 114.4	40	21.7 114.0	40	23	0	0.0 0.0	0	-0	0	0.0 0.0	0	-0	0	0.0 0.0	0	-0	0
082106Z	22.9 115.3	35	23.0 115.4	35	8	0	0.0 0.0	0	-0	0	0.0 0.0	0	-0	0	0.0 0.0	0	-0	0
082112Z	24.2 115.5	30	24.2 115.7	30	11	0	0.0 0.0	0	-0	0	0.0 0.0	0	-0	0	0.0 0.0	0	-0	0
082118Z	25.4 115.4	25	25.8 115.7	25	29	0	0.0 0.0	0	-0	0	0.0 0.0	0	-0	0	0.0 0.0	0	-0	0

	ALL FORECASTS WRNG	ALL FORECASTS 24-HR	ALL FORECASTS 48-HR	ALL FORECASTS 72-HR	TYPHOONS WHILE OVER 35 KTS WRNG	TYPHOONS WHILE OVER 35 KTS 24-HR	TYPHOONS WHILE OVER 35 KTS 48-HR	TYPHOONS WHILE OVER 35 KTS 72-HR
AVG FORECAST POSIT ERROR	25.	136.	311.	331.	0.	0.	0.	0.
AVG RIGHT ANGLE ERROR	9.	57.	123.	170.	0.	0.	0.	0
AVG INTENSITY MAGNITUDE ERROR	1.	3.	8.	15.	0.	0.	0.	0
AVG INTENSITY BIAS	-1.	1.	3.	9.	0.	0.	0.	0
NUMBER OF FORECASTS	24	20	16	7	0	0	0	0

DISTANCE TRAVELED BY TROPICAL CYCLONE IS 1009. NM

AVERAGE SPEED OF TROPICAL CYCLONE IS 7. KNOTS

TROPICAL STORM GERALD FIX POSITIONS FOR CYCLONE NO. 10

SATELLITE FIXES

FIX NO.	TIME (Z)	FIX POSITION	ACCRY	DVORAK CODE	COMMENTS	SITE
* 1	150241	20.0N 117.7E	PCN 5	T1.5/1.5	INIT OBS	RPMK
2	151022	19.0N 119.0E	PCN 6	T1.5/1.5	INIT OBS	PGTW
3	151800	19 6N 118.9E	PCN 6			PGTW
4	151938	20.0N 118.7E	PCN 5	T2.0/2.0	INIT OBS	PGTW
5	160016	19.8N 118.4E	PCN 5			RPMK
6	160220	19.9N 118.6E	PCN 3	T2.5/2.5 /D1.0/24HRS		RPMK
7	160600	20.3N 117.8E	PCN 6			PGTW
8	160823	20.0N 118.0E	PCN 5			RPMK
9	161113	20.1N 117 6E	PCN 5			RPMK
10	161113	20.4N 116.7E	PCN 5			RODN
11	16150:	19.5N 116.3E	PCN 6			RODN
12	161800	19 6N 115.5E	PCN 6			PGTW
13	162241	18.4N 115 1E	PCN 5			RODN
14	162352	18.7N 115 9E	PCN 3			RPMK
15	170000	19 0N 116.1E	PCN 6			PGTW
16	170200	18 6N 116.0E	PCN 3	T3.0/3.0-/D0 5/24HRS	EXP LLCC	RPMK
17	170200	18.4N 116.3E	PCN 4	T3 0/3.0	INIT OBS	PGTW
18	170600	18.5N 116.3E	PCN 4		EXP LLCC	PGTW
19	171049	18.4N 116.1E	PCN 6			PGTW
20	171121	18 6N 116.5E	PCN 4			RPMK
21	171441	17.9N 116.1E	PCN 6			RSKO
22	171800	19.0N 115.1E	PCN 6	T3.5/3.5 /D1.5/22HRS		PGTW
23	172055	18.0N 115.0E	PCN 5		ULCC FIX	RPMK
24	172220	18.3N 115.2E	PCN 3			RODN
25	172328	18.2N 114.4E	PCN 3			PGTW
26	172328	18.0N 114.8E	PCN 5	T3.0/3.0	INIT OBS ULCC FIX	RSKO
27	180140	18.2N 114.2E	PCN 3			PGTW
28	180600	18.1N 114.0E	PCN 6	T3 5/3.5-/S0.0/12HRS		PGTW
29	180758	18.5N 113.8E	PCN 5	T3 5/3 5 /D0.5/30HRS		RPMK
30	181100	18.4N 113.2E	PCN 3			RPMK
31	181206	18.3N 113.1E	PCN 6			PPMK
32	182042	18.0N 112.9E	PCN 3			RODN
33	182159	18 2N 112 5E	PCN 4			PGTW
34	190000	18.1N 112.5E	PCN 6			PGTW
35	190045	18.2N 112.9E	PCN 5	T3 5/3 5-/S0 0/19HRS		RPMK
36	190301	18 6N 112 6E	PCN 3			RPMK
37	190600	18 6N 112 4E	PCN 4	T3 0/3 0	INIT OBS	PGTW
38	190745	18 5N 111 9E	PCN 5	T3 5/3 5 /D0 5/30HRS		RSKO
39	191039	18 4N 112 0E	PCN 4			PGTW
40	191141	18 3N 112.0E	PCN 3			RPMK
41	191800	18.5N 111.8E	PCN 6	T3 0/3 0-/S0 0/24HRS		PGTW
42	192010	19 2N 111 7E	PCN 6			RODN
43	192319	19 4N 111 8E	PCN 5	T3 0/3.5 /W0 5/23HRS		RPMK
44	200000	19 4N 112 5E	PCN 6			PGTW
45	200020	19 9N 112 0E	PCN 5	T2 0/2 0	INIT OBS	RODN
46	200600	20 1N 112 9E	PCN 6	T3 0/3 0 /S0 0/24HRS		PGTW
47	200733	20 3N 113 4E	PCN 3			RPMK
48	200733	20 2N 112 5E	PCN 5	T3 5/3 5-/S0 0/24HRS		RSKO
49	201017	20 8N 113 1E	PCN 5			PGTW
50	201117	21 0N 113 2E	PCN 3		EXP LLCC	RPMK
51	201117	20 5N 112 9E	PCN 6			RODN
52	201200	20 9N 113 4E	PCN 6			PGTW
53	201521	21 7N 112 8E	PCN 6			RPMK
54	201800	21 4N 113 5E	PCN 6	T3 0/3.0-/S0 0/24HRS		PGTW
55	202356	21.4N 114 8E	PCN 3	T2.5/3 0 /W0.5/24HRS		RPMK
* 56	202356	21 7N 112 7E	PCN 5			RODN
57	210000	21.8N 113.7E	PCN 6			PGTW
58	210221	22 5N 115 4E	PCN 3		EXP LLCC	RPMK
59	210720	23 6N 114 9E	PCN 5			PGTW
60	211137	24.1N 115 6E	PCN 6			RPMK
* 61	211137	24.2N 113 8E	PCN 5			RODN
62	211200	25 8N 114 5E	PCN 6			PGTW
63	211501	24 7N 115 6E	PCN 6			RPMK
64	212236	26 4N 114 9E	PCN 6			RODN
65	212332	26 8N 114 3E	PCN 5			PPMK
66	212332	26 3N 115 1E	PCN 6			PGTW
67	220200	26 7N 114 6E	PCN 5			PPMK
68	230000	22 8N 121 4E	PCN 6			PGTW

AIRCRAFT FIXES

FIX NO	TIME (Z)	FIX POSITION	FLT LVL	700MB HGT	OBS MSLP	MAX-SFC-WND VEL/BRG/RNG	MAX-FLT-LVL-WND DIR/VEL/BRG/RNG	ACCRY NAV/MET	EYE SHAPE	EYE ORIEN-DIAM/TATION	EYE TEMP (C) OUT/ IN/ DP/SST	MSN NO
1	152335	20 0N 118 4E	1500FT		991	40 300 15	030 42 300 20	7 3	CIRCULAR	10	+24 +26 +26	1
2	162042	18 8N 116 1E	700MB	2929	979		310 47 190 32	20 2			+15 +16 +13	2
3	162313	18 5N 116 2E	700MB	2931	980	50 100 15	240 44 120 65	15 2			+12 +16 +14	2
4	170831	18 5N 116 3E	700MB	2941	980	55 030 20	360 50 280 90	5 5	CIRCULAR	20	+15 +17 +11	3
5	171032	18 5N 116 2E	1500FT		981	50 210 60	340 46 210 30	5 10			+23 +26 +23 29	3
6	172042	18 4N 114 9E	700MB	2930	979		170 52 090 118	10 2			+13 +14	4
7	172316	18 5N 114 8E	700MB	2932	980	50 170 20	150 39 040 21	15 2			+13 +18	4
8	180614	18 7N 114 2E	700MB	2952		55 120 45	190 49 120 45	12 10				5
9	180[illegible]44	1[illegible] 8N 113 6E	1500FT		984	45 120 40	200 46 120 120	12 7			+25 +27 +26 26	5

RADAR FIXES

FIX NO	TIME (Z)	FIX POSITION	RADAR	ACCRY	EYE SHAPE	EYE DIAM	RADOB-CODE ASWAR TDDFF	COMMENTS	RADAR POSITION	SITE WMO NO.
1	180800	18 3N 113 8E	LAND				5///5 72706		16 8N 112 3E	59981
2	181700	18 0N 112 6E	LAND				10203 72606		16 8N 112 3E	59981
3	182100	18 1N 112 5E	LAND				12834 72706		16 8N 112 3E	59981
4	182200	18 1N 112 4E	LAND				1271/ 72706		16 8N 112 3E	59981
5	182300	18 1N 112 4E	LAND				11713 52706		16 8N 112 3E	59981
6	190000	18 1N 112 3E	LAND				11814 52704		16 8N 112 3E	59981
7	190100	18 1N 112 3E	LAND				11614 52702		16 8N 112 3E	59981
8	190200	18 2N 112 3E	LAND				11634 53006		16 8N 112 3E	59981
9	190500	18 5N 112 1E	LAND				11614 53208		16 8N 112 3E	59981
10	190600	18 5N 111 9E	LAND				11934 52808		16 8N 112 3E	59981
11	190700	18 5N 111 9E	LAND				21933 52808		16 8N 112 3E	59981
12	190900	18 6N 111 9E	LAND				11713 53104		16 8N 112 3E	59981
13	191100	18 7N 112 0E	LAND				11523 53402		16 8N 112 3E	59981
14	191200	18 7N 112 1E	LAND				11814 53602		16 8N 112 3E	59981
15	191300	18 7N 112 2E	LAND				11814 53602		16 8N 112 3E	59981
16	191400	18 8N 112 2E	LAND				21814 53602		16 8N 112 3E	59981
17	191500	18 8N 112 2E	LAND				21814 53602		16 8N 112 3E	59981
18	191600	1[illegible] [illegible]N 112 1E	LAND				21744 53402		16 8N 112 3E	59981
19	191600	1[illegible] 7N 111 9E	LAND				5///3 52803		21 9N 112 0E	59663
20	191700	1[illegible] [illegible]N 112 1E	LAND				4///4 53402		16 8N 112 3E	59981
21	191800	1[illegible] [illegible]N 112 1E	LAND				4///4 53602		16 8N 112 3E	59981
22	192100	1[illegible] 2N 112 3E	LAND				5///4 50208		16 8N 112 3E	59981
23	192300	1[illegible] 5N 112 4E	LAND				5///4 50208		16 8N 112 3E	59981
24	200000	19 5N 112 4E	LAND				5///4 50202		16 8N 112 3E	59981
25	200100	19 5N 112 5E	LAND				5///4 50604		16 8N 112 3E	59981
26	200200	1[illegible] 6N 112 [illegible]E	LAND				11523 53605		21 9N 112 0E	59663
27	200400	1[illegible] 2N 112 7E	LAND				4//03 50406		16 8N 112 3E	59981
28	200500	19 9N 112 8E	LAND				4///1 50406		16 8N 112 3E	59981
29	200600	20 0N 112 8E	LAND				4///1 50306		16 8N 112 3E	59981
30	200200	20 2N 113 1E	LAND				6590/ /////		22 3N 114 2E	45005
31	200800	20 3N 113 1E	LAND				5///1 50406		16 8N 112 3E	59981
32	200900	20 2N 113 2E	LAND				2297/ /////		22 3N 114 2E	45005
33	200900	20 4N 113 2E	LAND				5///1 50306		16 8N 112 3E	59981
34	201000	20 4N 113 4E	LAND				35/6/ /////		22 3N 114 2E	45005
35	201100	20 6N 113 4E	LAND				3595/ 70310		22 3N 114 2E	45005
36	201100	20 5N 112 8E	LAND				6///1 63310		21 9N 112 0E	59663
37	201200	20 7N 113 4E	LAND				2097/ 70310	PDR ECHO OPN TO E	22 3N 114 2E	45005
38	201300	20 7N 113 3E	LAND				1097/ 70310		22 3N 114 2E	45005
39	201400	21 0N 113 5E	LAND				2091/ 70309		22 3N 114 2E	45005
40	201500	21 1N 113 6E	LAND				3191/ 70309		22 3N 114 2E	45005
41	201600	21 2N 113 5E	LAND				2594/ 70309		22 3N 114 2E	45005
42	201700	21 5N 113 6E	LAND				2091/ 70310		22 3N 114 2E	45005
43	201800	21 5N 113 6E	LAND				3594/ 70309		22 3N 114 2E	45005
44	201900	21 7N 113 5E	LAND				2594/ 73609		22 3N 114 2E	45005
45	202000	21 7N 113 6E	LAND				3594/ 73604		22 3N 114 2E	45005
46	202100	21 5N 113 8E	LAND				2594/ 73604		22 3N 114 2E	45005
47	202200	21 5N 113 9E	LAND				3594/ 70904		22 3N 114 2E	45005
48	202300	21 6N 114 1E	LAND				2582/ 60510		22 3N 114 2E	45005
49	210000	21 5N 114 6E	LAND				3591/ 80910		22 3N 114 2E	45005
50	210100	21 7N 114 4E	LAND				6594/ 70510		22 3N 114 2E	45005
51	210200	22 0N 114 6E	LAND				6594/ 70510		22 3N 114 2E	45005
52	210300	22 3N 114 7E	LAND				6594/ 80312		22 3N 114 2E	45005

SYNOPTIC FIXES

FIX NO	TIME (Z)	FIX POSITION	INTENSITY ESTIMATE	NEAREST DATA (NM)	COMMENTS
1	210000	22 1N 114 5E	040	024	
2	210300	21 5N 115 1E	035	024	
3	210900	23 5N 115 9E	030	025	59317 59316 59303

NOTICE - THE ASTERISKS (*) INDICATE FIXES UNREPRESENTATIVE AND NOT USED FOR BEST TRACK PURPOSES

TYPHOON HOLLY
BEST TRACK DATA

	BEST TRACK			WARNING					24 HOUR FORECAST					48 HOUR FORECAST					72 HOUR FORECAST				
							ERRORS					ERRORS					ERRORS					ERRORS	
MO/DA/HR	POSIT		WIND	POSIT		WIND	DST	WIND	POSIT		WIND	DST	WIND	POSIT		WIND	DST	WIND	POSIT		WIND	DST	WIND
081412Z	19.3	137.6	25	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0	0
081418Z	19.6	136.8	30	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0	0.0	0.0	0	-0.	0.	0.0	0.0	0	-0.	0
081500Z	20.0	135.8	30	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0	0.	0.0	0.0	0	-0.	0.	0.0	0.0	0.	-0	0
081506Z	20.3	134.8	35	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
081512Z	21.1	134.1	35	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0	-0.	0.	0.0	0.0	0	-0.	0.
081518Z	21.9	133.4	40	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0	-0.	0.	0.0	0.0	0	-0	0
081600Z	22.6	132.6	40	22.5	132.6	40.	6.	0.	25.3	129.5	60.	147.	5.	27.2	125.6	80.	258.	15.	31.1	122.7	65	344.	-5
081606Z	22.8	131.8	45	22.8	132.3	40.	28.	-5.	25.8	128.5	60.	182.	0.	27.8	124.7	80.	257.	15	32.2	122.5	65	380.	-5.
081612Z	22.8	131.1	45	22.8	131.2	45.	6.	0.	25.2	127.7	65.	153.	5.	27.9	124.4	85	214	20	31.2	121.8	70.	323.	-5.
081618Z	22.8	130.5	50	22.8	130.5	50.	0.	0.	23.9	127.3	70.	88.	10	26.0	123.9	90.	131	25	28.3	120.4	80	312.	5
081700Z	22.9	130.0	55	22.7	129.6	60.	25.	5.	23.5	126.2	75.	110.	10.	25.1	122.3	90.	216.	20	26.9	118.3	50	446	-25
081706Z	22.9	129.5	60	22.8	129.5	60.	6.	0.	23.2	126.6	80.	91.	15.	24.9	122.7	90.	225	20	26.6	118.8	50.	449.	-25.
081712Z	23.0	129.1	60	23.1	128.4	60.	39.	0.	23.9	125.6	80.	109.	15	25.4	122.6	90.	251.	15.	27.8	119.2	60.	430.	-15
081718Z	23.2	128.7	60	23.3	127.7	60.	55.	0.	24.5	124.9	80.	105.	15	26.3	121.9	90	272.	15	28.7	118.4	40	478.	-30.
081800Z	23.6	128.2	65	23.4	128.2	60.	12.	-5.	24.5	126.1	75.	102.	5.	26.8	123.7	90	209.	15.	30.1	121.3	50	375.	-15.
081806Z	24.4	127.6	65	24.0	127.5	60.	25.	-5.	25.8	125.1	75.	88.	5	28.1	122.7	90	226.	15.	31.5	120.2	50.	467.	-10.
081812Z	25.2	127.0	65	25.2	126.9	60.	5.	-5.	28.1	124.5	60	109.	-15.	31.0	122.0	50	231.	-25.	34.5	120.6	40.	485.	-15.
081818Z	25.7	126.3	65	25.9	126.4	60.	13.	-5.	28.9	124.1	60.	117	-15.	32.2	122.4	50.	230	-20.	35.8	122.3	45.	492.	-5.
081900Z	26.2	126.1	70	26.2	126.1	70.	0.	0.	28.8	124.4	75.	103.	0.	32.7	123.2	65.	233.	0.	37.4	123.8	50.	524.	5.
081906Z	26.8	126.3	70	26.8	126.0	70.	16.	0.	29.4	125.5	70.	65.	-5.	33.0	125.4	60.	189.	0	0.0	0.0	0.	-0.	0.
081912Z	27.7	126.5	75	27.5	126.6	75.	13.	0.	30.3	126.6	75.	48.	0.	33.5	127.1	60	139.	5.	0.0	0.0	0.	-0.	0.
081918Z	28.6	126.3	75	28.5	126.5	75.	12.	0.	32.0	126.7	70.	16.	0.	35.3	128.0	55	232.	5	0.0	0.0	0	-0.	0.
082000Z	29.5	126.2	75	29.5	126.4	75.	10.	0.	33.2	126.7	70.	57.	5.	37.1	128.0	45.	332.	0.	0.0	0.0	0	-0.	0.
082006Z	30.3	126.2	75	30.3	126.4	75.	10.	0.	33.7	126.7	65.	114.	5.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
082012Z	31.1	126.5	75	31.2	126.5	75.	6.	0.	35.3	127.2	55.	157.	0.	0.0	0.0	0	-0.	0.	0.0	0.0	0.	-0.	0.
082018Z	31.8	126.9	70	32.0	126.6	70.	19.	0.	36.3	128.2	50.	205.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
082100Z	33.0	127.8	65	33.1	127.9	65.	8.	0.	36.9	131.9	45.	165.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
082106Z	34.2	128.9	60	33.9	128.9	60.	18.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0
082112Z	35.4	130.4	55	35.1	130.2	55.	20.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0	0.
082118Z	36.8	132.4	50	36.6	132.8	50.	23.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0	0.
082200Z	38.4	134.8	45	38.5	135.0	45.	11.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.

	ALL FORECASTS				TYPHOONS WHILE OVER 35 KTS			
	WRNG	24-HR	48-HR	72-HR	WRNG	24-HR	48-HR	72-HR
AVG FORECAST POSIT ERROR	16.	111.	230.	423.	16.	111.	230.	423.
AVG RIGHT ANGLE ERROR	11.	73.	149.	316.	11.	73.	149.	316.
AVG INTENSITY MAGNITUDE ERROR	1.	6.	14.	13.	1.	6.	14.	13.
AVG INTENSITY BIAS	-1.	3.	8.	-11.	-1.	3.	8.	-11.
NUMBER OF FORECASTS	25	21	17	13	25	21	17	13

DISTANCE TRAVELED BY TROPICAL CYCLONE IS 1712. NM

AVERAGE SPEED OF TROPICAL CYCLONE IS 10. KNOTS

TYPHOON HOLLY
FIX POSITIONS FOR CYCLONE NO. 11

SATELLITE FIXES

FIX NO.	TIME (Z)	FIX POSITION	ACCRY	DVORAK CODE	COMMENTS	SITE
1	121800	17.9N 140.8E	PCN 6	T0.0/0.0	INIT OBS	PGTW
2	122043	17.5N 138.6E	PCN 6		ULCC FIX	PGTW
3	130923	17.3N 139.0E	PCN 5	T0.5/0.5	INIT OBS	PGTW
4	140902	19.0N 138.3E	PCN 6	T1.0/1.0 /D0.5/24HRS		PGTW
5	141200	19.7N 137.1E	PCN 6			PGTW
6	141400	19.8N 136.9E	PCN 5			PGTW
7	141800	19.6N 136.8E	PCN 6	T2.0/2.0 /D1.0/09HRS		PGTW
8	142142	20.0N 136.4E	PCN 5			PGTW
* 9	142259	19.5N 138.0E	PCN 3	T1.5/1.5	INIT OBS	RODN
10	150000	19.3N 136.0E	PCN 6		ULCC FIX	PGTW
11	150653	20.3N 133.8E	PCN 6			RODN
12	150956	19.9N 134.4E	PCN 6			RSKO
13	151022	20.0N 134.1E	PCN 6		ULCC FIX	PGTW
14	151340	21.5N 133.9E	PCN 5			PGTW
15	151800	22.2N 133.8E	PCN 6			PGTW
16	151938	22.0N 133.5E	PCN 5	T2.5/2.5 /D0.5/26HRS		PGTW
17	152235	23.0N 132.1E	PCN 3		EXP LLCC	PGTW
18	160038	23.3N 132.1E	PCN 4		EXP LLCC	PGTW
* 19	160641	21.8N 132.7E	PCN 6	T3.0/3.0	ULCC FIX	PGTW
* 20	160641	21.9N 132.7E	PCN 5	T3.0/3.0	INIT OBS	RODN
* 21	161001	22.0N 132.6E	PCN 6		ULCC FIX	PGTW
22	161319	22.6N 131.0E	PCN 5		ULCC FIX	PGTW
23	161926	22.6N 130.5E	PCN 5	T3.5/3.5 /D1.0/24HRS		PGTW
24	162100	22.8N 130.3E	PCN 5			PGTW
25	162211	22.9N 130.0E	PCN 5			PGTW
26	170000	22.8N 129.5E	PCN 6			PGTW
27	170200	22.7N 129.5E	PCN 6		ULCC FIX	PGTW
28	170628	23.1N 128.7E	PCN 5	T3.5/3.5 /D0.5/24HRS		PGTW
29	170940	23.2N 128.3E	PCN 6		ULCC FIX	PGTW
30	171049	23.2N 128.3E	PCN 6			PGTW
31	171441	22.5N 128.3E	PCN 3			RSKO
32	171913	23.4N 127.7E	PCN 6	T3.5/3.5+/S0.0/24HRS		PGTW
33	172038	22.9N 128.1E	PCN 4			PGTW
34	172328	23.3N 127.7E	PCN 3	T4.0/4.0	INIT OBS	RSKO
35	172328	23.2N 128.3E	PCN 5			PGTW
36	180140	23.6N 127.9E	PCN 3			PGTW
37	180615	24.3N 127.6E	PCN 3	T2.5/3.5+/W1.0/24HRS		PGTW
38	180918	24.8N 127.4E	PCN 5		ULCC FIX	PGTW
39	181025	24.8N 127.3E	PCN 5		ULCC FIX	PGTW
* 40	181100	24.5N 122.9E	PCN 5		ULCC FIX	RPMK
41	181900	26.0N 125.5E	PCN 6	T3.5/3.5 /S0.0/24HRS	ULCC FIX	PGTW
42	182042	26.0N 126.1E	PCN 5			RODN
43	182159	25.8N 125.7E	PCN 4		EYEWALL OPN NE	PGTW
44	182303	26.4N 125.4E	PCN 3	T4.0/4.0 /S0 0/24HRS		RSKO
45	182303	26.0N 126.0E	PCN 4			PGTW
46	190120	26.1N 126.0E	PCN 3			PGTW
47	190600	26.7N 126.3E	PCN 4	T3 5/3.5 /D1 0/24HRS		PGTW
48	190745	26.8N 125.8E	PCN 5			RSKO
49	191039	26.9N 126.4E	PCN 4			PGTW
50	191200	27.5N 126.7E	PCN 4			PGTW
51	191400	28.2N 126.3E	PCN 5		ULCC FIX	PGTW
52	191800	28.4N 126.1E	PCN 6	T4 0/4.0-/D0.5/23HRS	ULCC FIX	PGTW
53	192010	28.8N 125.6E	PCN 4			RODN
54	192137	28 7N 125 8E	PCN 3			PGTW
55	192239	28.8N 125 9E	.CN 3		PARTIAL EYEWALL S-SE	PGTW
56	200059	29.6N 126 3E	PCN 3			PGTW
57	200600	30.0N 126.1E	PCN 4	T4 0/4.0-/D0 5/24HRS		PGTW
58	200733	30 1N 126 5E	PCN 3	T4.0/4.0 /S0 0/31HRS		RSKO
59	200733	30 0N 126 2E	PCN 3	T4 0/4 0	INIT OBS	RPMK
60	200900	30.4N 126.2E	PCN 6		ULCC FIX	PGTW
61	201117	31 2N 126 2E	PCN 4			RODN
62	201200	31 1N 126.4E	PCN 4			PGTW
63	201340	31 1N 126 5E	PCN 4			PGTW
64	201800	31 7N 126 9E	PCN 4	T3.0/4 0-/W1 0/24HRS		PGTW
65	202017	32 0N 127 1E	PCN 4			RODN
66	202116	32 1N 127 2E	PCN 6			PGTW
67	202356	32 6N 128 4E	PCN 3			RODN
68	202356	32 7N 128 2E	PCN 3	T3 5/4 0-/W0 5/25HRS		RPMK
69	210039	33 3N 128 1E	PCN 5		ULCC FIX	PGTW
70	210720	34 6N 129 3E	PCN 5	T2 5/3 5-/W1 5/24HRS		RSKO
71	210956	35 0N 129 7E	PCN 5	T2 5/3 5-/W1 5/27HRS		PGTW
72	211053	35 0N 130 1E	PCN 6			RSKO
73	211200	35 2N 130 4E	PCN 6		ULCC FIX	PGTW

	74	211320	35 3N 131 2E	PCN 6		PGTW
	75	212005	37 3N 132 4E	PCN 6		RSKO
	76	212332	38 7N 133 8E	PCN 5		RSKO
	77	222000	38 6N 134 7E	PCN 6		PGTW
	78	220526	40 7N 135 7E	PCN 3		RODN
*	79	220526	38 5N 138 2E	PCN 6		PGTW
	80	220935	41 4N 136 4E	PCN 3	ULCC FIX	RSKO
	81	230000	42 3N 139 7E	PCN 4	EXP LLCC	PGTW

AIRCRAFT FIXES

FIX NO.	TIME (Z)	FIX POSITION	FLT LVL	700MB HGT	OBS MSLP	MAX-SFC-WND VEL/BRG/RNG	MAX-FLT-LVL-WND DIR/VEL/BRG/RNG	ACCRY NAV/MET	EYE SHAPE	EYE ORIEN- DIAM/TATION	EYE TEMP (C) OUT/ IN/ DP/SST	MSN NO.
1	160225	23 0N 132 3E	1500FT		992	55 210 130	270 52 210 130	3 3			+25 +25 +24 29	2
2	160620	22 5N 132 0E	1500FT		990	25 080 32	080 15 090 55	10 10			+25 +25	3
3	160856	22 6N 131 3E	1500FT		987	50 160 20	280 42 220 70	10 2			+25 +26	3
4	162055	22 8N 130 3E	700MB	2951		57 040 90	060 53 340 70	20 30			+16 +13 +11	4
5	162330	22 5N 129 7E	700MB	2942		70 350 60	100 65 350 15	10 20			+13 +13 +12	4
6	170653	22 9N 129 6E	700MB	2892		70 350 80	090 62 350 75	10 10			+14 +14	5
7	170833	23 0N 129 2E	700MB	2892	977	70 350 145	070 70 350 107	5 5			+13 +13	5
8	172036	23 3N 128 3E	700MB	2856	970	65 080 70	200 74 090 110	10 30			+13 +15 +10	6
9	172343	23 6N 128 3E	700MB	2863	973	60 350 90	250 75 170 120	5 15	CIRCULAR	60	+15 +15 +11	6
10	180900	25 1N 127 3E	700MB	2855		40 210 120	130 67 030 100	5 10			+15 +16 +13	7
11	181134	25 2N 127 0E	700MB	2845			220 61 120 115	2 15			+15 +17 +15	7
12	182344	26 0N 126 3E	700MB	2811	964	50 220 30	230 39 290 93	5 5	CIRCULAR	5	+13 +16 +12	8
13	190226	26 4N 126 2E	700MB	2799	963	45 310 90	240 57 150 120	5 5				8
14	190832	26 9N 126 6E	700MB	2818		75 050 90	260 75 170 58	5 3	CIRCULAR	15	+14 +16 +15	9
15	191127	27 7N 126 8E	700MB	2814	966	40 290 130	280 40 220 120	5 3	CIRCULAR	15	+15 +16 +15	9
16	192142	29 2N 126 2E	700MB	2804		75 130 120	220 72 120 87	12 2			+14 +16 +12	10
17	192338	29 5N 126 4E	700MB	2812	965	60 050 45	160 61 050 65	12 3			+16 +16 +16	10
18	200850	30 7N 126 3E	700MB	2797	965	70 130 60	220 73 140 140	10 10			+15 +16	11
19	201125	31 2N 126 7E	700MB	2806			280 78 210 135	15 10			+14 +16	11
20	202045	32 5N 127 3E	700MB	2853	973		270 70 180 60	10 5				12
21	202330	33 1N 127 7E	700MB	2862	975		230 56 140 125	5 5	CIRCULAR	25	+14 +13 +13	12

RADAR FIXES

	FIX NO	TIME (Z)	FIX POSITION	RADAR	ACCRY	EYE SHAPE	EYE DIAM	RADOB-CODE ASWAR TDDFF	COMMENTS	RADAR POSITION	SITE WMO NO
*	1	170500	23 6N 128 7E	LAND				54512 5////		26 2N 127 8E	47937
	2	180800	25 0N 127 5E	LAND				6///5 5////		24 8N 125 3E	47927
	3	180900	25 0N 127 5E	LAND				6///6 50000		24 8N 125 3E	47927
	4	181000	25 3N 127 4E	LAND				6///5 53519		24 8N 125 3E	47927
	5	181100	25 4N 127 1E	LAND				6///4 52919		24 8N 125 3E	47927
	6	181200	25 0N 127 3E	LAND				64//3 5////		26 2N 127 8E	47937
	7	181200	25 5N 127 0E	LAND				6///4 53008		24 8N 125 3E	47927
	8	181300	25 1N 127 1E	LAND				64/12 53111		26 2N 127 8E	47937
	9	181400	25 1N 127 0E	LAND				54/02 52704		26 2N 127 8E	47937
	10	181400	25 1N 127 1E	LAND				6///4 5////		24 8N 125 3E	47927
	11	181500	25 2N 127 1E	LAND				54/13 50308		26 2N 127 8E	47937
	12	181500	25 3N 127 1E	LAND				5///4 53615		24 8N 125 3E	47927
	13	181600	25 5N 127 1E	LAND				54/12 73608		26 2N 127 8E	47937
	14	181600	25 5N 127 1E	LAND				5///4 53611		24 8N 125 3E	47927
	15	181600	25 4N 126 3E	LAND				6///3 53012		27 6N 121 1E	58760
	16	181700	25 8N 127 0E	LAND				54/12 73614		26 2N 127 3E	47937
	17	181700	25 5N 126 2E	LAND				6///3 53012		27 6N 121 1E	58760
	18	181700	25 7N 127 2E	LAND	POOR		60		MOV 3620	26 2N 127 7E	47936
	19	181800	26 1N 126 8E	LAND				6///4 53019		24 8N 125 3E	47927
	20	181800	25 7N 126 1E	LAND				6///3 53212		27 6N 121 1E	58760
	21	181800	26 1N 126 8E	LAND				54/32 73416		26 2N 127 8E	47937
	22	181800	26 0N 126 7E	LAND	POOR		60		MOV 3250	26 2N 127 7E	47936
	23	181900	25 9N 125 9E	LAND				6///3 5////		27 6N 121 1E	58760
*	24	181900	26 4N 126 5E	LAND				6///4 53222		24 8N 125 3E	47927
	25	181900	26 2N 126 3E	LAND				54/12 73219		26 2N 127 8E	47937
	26	181900	26 2N 126 3E	LAND	POOR		60		MOV 3140	26 2N 127 7E	47936
	27	182000	26 2N 125 8E	LAND				54/12 72923		26 2N 127 8E	47937
*	28	182100	16 3N 125 6E	LAND				6///3 53215		27 6N 121 1E	58760
	29	182100	26 1N 125 8E	LAND				54/12 72718		26 2N 127 8E	47937
	30	182200	25 7N 126 1E	LAND				10282 72011		26 2N 127 8E	47937
	31	182200	25 8N 126 1E	LAND				6///4 5////		24 8N 125 3E	47927
	32	182300	25 9N 126 2E	LAND				20442 71410		26 2N 127 8E	47937
	33	182300	25 9N 126 1E	LAND				35//3 50///		24 8N 125 3E	47927
	34	190000	26 0N 126 2E	LAND				54/52 50105		26 2N 127 8E	47937
	35	190000	26 2N 126 1E	LAND				3///4 53614		24 8N 125 3E	47927
	36	190100	26 2N 126 1E	LAND				54/12 73610		26 2N 127 8E	47937
*	37	190200	27 0N 125 8E	LAND				5///2 52410		27 6N 121 1E	58760
	38	190200	26 3N 126 1E	LAND				65//2 73609		26 2N 127 8E	47937
.	39	190300	26 6N 126 2E	LAND				6///4 73608		24 8N 125 3E	47927
	40	190300	26 5N 126 1E	LAND				65//2 73510		26 2N 127 8E	47937
	41	190400	26 5N 126 1E	LAND				64//2 73608		26 2N 127 8E	47937
	42	190400	26 5N 126 1E	LAND				6///3 51905		24 8N 125 3E	47927
*	43	190400	27 0N 125 8E	LAND				5///2 53405		27 6N 121 1E	58760
	44	190500	26 3N 126 1E	LAND				5///4 51812		24 8N 125 3E	47927
	45	190500	26 5N 126 1E	LAND				64/13 73608		26 2N 127 8E	47937
*	46	190500	27 0N 125 8E	LAND				5///3 53405		27 6N 121 1E	58760
	47	190600	26 6N 126 0E	LAND				6///3 53422		24 8N 125 3E	47927
	48	190600	26 6N 126 2E	LAND				64/13 70302		26 2N 127 8E	47937
	49	190700	26 7N 126 2E	LAND				64/13 70204		26 2N 127 8E	47937
	50	190700	26 7N 125 9E	LAND				6///3 52805		24 8N 125 3E	47927
	51	190700	27 0N 125 8E	LAND				5///3 53405		27 6N 121 1E	58760
	52	190800	27 0N 125 8E	LAND				5///3 50000		27 6N 121 1E	58760
	53	190800	26 8N 126 2E	LAND				64/12 70306		26 2N 127 8E	47937
	54	190900	27 1N 126 4E	LAND				54/12 70210		26 2N 127 8E	47937
*	55	191000	27 0N 125 8E	LAND				5///3 50000		27 6N 121 1E	58760
*	56	191100	27 2N 125 7E	LAND				5///4 53408		27 6N 121 1E	58760
	57	191100	27 3N 126 6E	LAND				64/12 70215		26 2N 127 8E	47937
	58	191200	27 7N 126 5E	LAND				54/73 70112		26 2N 127 8E	47937
*	59	191300	27 5N 125 5E	LAND				5///4 53408		27 6N 121 1E	58760
	60	191300	27 9N 126 5E	LAND				64/14 73611		26 2N 127 8E	47937
	61	191400	28 3N 126 5E	LAND				35/04 5////		28 4N 129 5E	47909
	62	191400	28 4N 126 6E	LAND				65//3 73617		26 2N 127 8E	47937
*	63	191400	27 7N 125 6E	LAND				5///4 53408		27 6N 121 1E	58760
*	64	191500	28 8N 126 6E	LAND				75//3 73621		26 2N 127 8E	47937
	65	191500	28 6N 126 5E	LAND				35//4 53616		28 4N 129 5E	47909
*	66	191500	27 8N 125 5E	LAND				5///4 53408		27 6N 121 1E	58760
*	67	191600	28 0N 125 3E	LAND				5///4 53409		27 6N 121 1E	58760
	68	191600	28 9N 126 5E	LAND				35//4 53616		28 4N 129 5E	47909
*	69	191700	28 1N 125 5E	LAND				5///4 53409		27 6N 121 1E	58760
*	70	191800	28 2N 125 5E	LAND				5///4 53409		27 6N 121 1E	58760
	71	191900	28 4N 125 5E	LAND				5///4 53409		27 6N 121 1E	58760
	72	192000	28 5N 126 3E	LAND				65/04 5////		28 4N 129 5E	47909
*	73	192100	28 6N 125 5E	LAND				6///4 53412		27 6N 121 1E	58760
	74	192100	28 8N 126 2E	LAND				65/04 53516		28 4N 129 5E	47909
*	75	192200	28 8N 125 5E	LAND				6///4 53412		27 6N 121 1E	58760
	76	192200	29 0N 126 2E	LAND				65//5 53611		28 4N 129 5E	47909
	77	192300	29 2N 126 2E	LAND				65//5 53613		28 4N 129 5E	47909
*	78	200000	29 2N 125 6E	LAND				6///4 53612		27 6N 121 1E	58760
	79	200000	29 6N 126 3E	LAND				65//5 50224		28 4N 129 5E	47909
	80	200100	29 4N 125 6E	LAND				6///4 53612		27 6N 121 1E	58760
	81	200200	29 7N 125 8E	LAND				6///4 50112		27 6N 121 1E	58760
	82	200300	30 0N 126 0E	LAND				7///3 50212		27 6N 121 1E	58760
	83	202300	32 7N 127 5E	LAND				6///3 5////		33 4N 130 4E	47806
	84	210000	33 0N 127 7E	LAND				6///3 50319		33 4N 130 4E	47806
	85	210100	33 2N 128 0E	LAND				6///3 50519		33 4N 130 4E	47806
	86	210200	33 4N 128 2E	LAND				6///3 50416		33 4N 130 4E	47806
	87	210300	33 6N 128 4E	LAND				6///3 50416		33 4N 130 4E	47806
	88	210400	33 8N 128 6E	LAND				6///3 50411		33 4N 130 4E	47806
	89	210500	33 9N 128 8E	LAND				6///2 50411		33 4N 130 4E	47806
	90	210600	34 0N 129 0E	LAND				6///2 50513		33 4N 130 4E	47806
	91	210700	34 4N 129 2E	LAND				20403 50222		33 4N 130 4E	47806
	92	210800	34 5N 129 4E	LAND				21443 50413		33 4N 130 4E	47806
	93	210900	34 6N 129 7E	LAND				21123 50716		33 4N 130 4E	47806
	94	210900	34 5N 129 8E	LAND				35/52 5////		34 3N 132 6E	47792
	95	211000	34 6N 130 2E	LAND				21313 50924		33 4N 130 4E	47806
	96	211000	34 7N 129 8E	LAND				65/52 5////		34 3N 132 6E	47792
	97	211100	34 6N 130 5E	LAND				25462 50916		33 4N 130 4E	47806
	98	211100	35 2N 130 4E	LAND				65//1 5////		35 5N 133 1E	47791

99	211300	35.6N 131.2E	LAND	65/51 50422	34.3N 132.6E	47792
100	211300	35.6N 131.1E	LAND	304/1 50327	33.4N 130.4E	47806
101	211300	35.6N 131.2E	LAND	65/// 50527	35.5N 133.1E	47791
102	211400	35.8N 131.4E	LAND	55//1 50522	33.4N 130.4E	47806
103	211400	35.9N 131.4E	LAND	65/51 50422	34.3N 132.6E	47792
104	211400	35.9N 131.3E	LAND	55/// 50322	35.5N 133.1E	47791
105	211500	36.1N 131.8E	LAND	65/1/ 50622	34.3N 132.6E	47792
106	211500	36.2N 131.6E	LAND	5///1 50322	33.4N 130.4E	47806
107	211500	36.2N 131.5E	LAND	55/// 50322	35.5N 133.1E	47791
108	211600	36.5N 131.8E	LAND	65/// 50622	35.5N 133.1E	47791
109	211700	36.7N 133.2E	LAND	65/// 50622	35.5N 133.1E	47791
110	211800	36.8N 132.7E	LAND	65/// 50724	35.5N 133.1E	47791
111	211900	37.0N 133.2E	LAND	65/// 50727	35.5N 133.1E	47791
112	212000	37.2N 133.6E	LAND	65/// 50527	35.5N 133.1E	47791
113	212100	37.5N 134.0E	LAND	65/// 50527	35.5N 133.1E	47791
114	212200	37.6N 134.5E	LAND	65/// 50622	35.5N 133.1E	47791
115	212300	37.9N 134.9E	LAND	75/// 50622	35.5N 133.1E	47791
*116	220100	38.7N 137.7E	LAND	6//// /////	37.7N 138.8E	47572
*117	220200	39.2N 137.0E	LAND	///// /////	37.7N 138.8E	47572

SYNOPTIC FIXES

FIX NO.	TIME (Z)	FIX POSITION	INTENSITY ESTIMATE	NEAREST DATA (NM)	COMMENTS
1	181800	25.8N 126.3E	060	040	47929 47936 47927

NOTICE - THE ASTERISKS (*) INDICATE FIXES UNREPRESENTATIVE AND NOT USED FOR BEST TRACK PURPOSES.

TROPICAL DEPRESSION 12
BEST TRACK DATA

	BEST TRACK		WARNING				24 HOUR FORECAST				48 HOUR FORECAST				72 HOUR FORECAST			
					ERRORS				ERRORS				ERRORS				ERRORS	
MO/DA/HR	POSIT	WIND	POSIT	WIND	DST	WIND	POSIT	WIND	DST	WIND	POSIT	WIND	DST	WIND	POSIT	WIND	DST	WIND
082300Z	19 1 142 7	20	0 0 0 0	0	-0	0	0 0 0 0	0	-0	0	0 0 0 0	0	-0	0	0 0 0 0	0	-0	0
082306Z	19 5 141 8	20	0 0 0 0	0	-0	0	0 0 0 0	0	-0	0	0 0 0 0	0	-0	0	0 0 0 0	0	-0	0
082312Z	19 7 140 8	20	0 0 0 0	0	-0	0	0 0 0 0	0	-0	0	0 0 0 0	0	-0	0	0 0 0 0	0	-0	0
082318Z	20 0 139 8	20	0 0 0 0	0	-0	0	0 0 0 0	0	-0	0	0 0 0 0	0	-0	0	0 0 0 0	0	-0	0
082400Z	20 3 138 7	20	20 4 139 0	25	18	5	21 2 135 9	45	204	25	0 0 0 0	0	-0	0	0 0 0 0	0	-0	0
082406Z	20 8 137 4	20	20 7 137 5	30	8	10	0 0 0 0	0	-0	0	0 0 0 0	0	-0	0	0 0 0 0	0	-0	0
082412Z	21 4 136 1	20	21 0 136 8	25	46	5	0 0 0 0	0	-0	0	0 0 0 0	0	-0	0	0 0 0 0	0	-0	0
082418Z	22 2 134 5	20	21 0 136 8	25	147	5	0 0 0 0	0	-0	0	0 0 0 0	0	-0	0	0 0 0 0	0	-0	0
082500Z	23 3 133 0	20	23 5 133 1	25	13	5	0 0 0 0	0	-0	0	0 0 0 0	0	-0	0	0 0 0 0	0	-0	0

	ALL FORECASTS				TYPHOONS WHILE OVER 35 KTS			
	WRNG	24-HR	48-HR	72-HR	WRNG	24-HR	48-HR	72-HR
AVG FORECAST POSIT ERROR	46	204	0	0	0	0	0	0
AVG RIGHT ANGLE ERROR	8	16	0	0	0	0	0	0
AVG INTENSITY MAGNITUDE ERROR	6	25	0	0	0	0	0	0
AVG INTENSITY BIAS	6	25	0	0	0	0	0	0
NUMBER OF FORECASTS	5	1	0	0	0	0	0	0

DISTANCE TRAVELED BY TROPICAL CYCLONE IS 605 NM

AVERAGE SPEED OF TROPICAL CYCLONE IS 13 KNOTS

TROPICAL DEPRESSION TD12W
FIX POSITIONS FOR CYCLONE NO 12

SATELLITE FIXES

	FIX NO	TIME (Z)	FIX POSITION	ACCRY	DVORAK CODE	COMMENTS	SITE
*	1	212151	17 0N 142 0E	PCN 6	T1 0/1 0	INIT OBS	PGTW
*	2	220000	16 7N 143 2E	PCN 6		ULCC FIX	PGTW
*	3	220526	17 0N 138 2E	PCN 6		ULCC FIX	PGTW
	4	222034	19 1N 143 5E	PCN 6			PGTW
*	5	222359	19 8N 142 4E	PCN 5	T1 5/1 5 /D0 5/26HRS		PGTW
*	6	230600	20 3N 140 8E	PCN 6			PGTW
	7	230914	17 0N 141 4E	PCN 6		ULCC FIX	PGTW
*	8	231005	19 7N 142 4E	PCN 6		ULCC FIX	PGTW
	9	2312[illegible]	20 4N 141 1E	PCN 6		ULCC FIX SCNDRY 18 6N 142 3E	PGTW
*	10	231[illegible]	19 2N 141 4E	PCN 6	T2 0/2 0	INIT OBS	PGTW
	11	232012	19 5N 140 6E	PCN 6			PGTW
	12	240000	20 5N 139 4E	PCN 6		ULCC FIX	PGTW
	13	240120	20 5N 139 2E	PCN 6	T2 0/2 0 /D0 5/25HRS	ULCC FIX	PGTW
	14	24064[illegible]	21 [illegible]N 137 6E	PCN 6		ULCC 24 4N 136 9E	PGTW
	15	2408[illegible]	21 6N 137 5E	PCN 6		ULCC FIX	PGTW
*	16	240941	19 5N 139 1E	PCN 6		ULCC FIX SCNDRY 25 3N 136 1E	PGTW
*	17	2419[illegible]	17 0N 138 3E	PCN 5			PGTW
*	18	2421[illegible]	17 5N 137 9E	PCN 5			PGTW
*	19	242219	17 8N 137 7E	PCN 5			PGTW

AIRCRAFT FIXES

FIX NO	TIME (Z)	FIX POSITION	FLT LVL	700MB HGT	OBS MSLP	MAX-SFC-WND VEL/BRG/RNG	MAX-FLT-LVL-WND DIR/VEL/BRG/RNG	ACCRY NAV/MET	EYE SHAPE	EYE ORIEN-DIAM/TATION	EYE TEMP (C) OUT/ IN/ DP/SST	MSN NO
1	240010	20 [illegible] 138 4E	1500FT		999	20 100 90	160 20 100 90	15 40			+26 +25	2
2	240[illegible]	[illegible] 137 2E	1500FT		995	20 140 150	160 20 030 90	10 60			+25 +25 +23	3

NOTICE - THE ASTERISKS (*) INDICATE FIXES UNREPRESENTATIVE AND NOT USED FOR BEST TRACK PURPOSES

TYPHOON IKE
BEST TRACK DATA

MO/DA/HR	BEST TRACK POSIT		BEST TRACK WIND	WARNING POSIT		WARNING WIND	WARNING ERRORS DST	WARNING ERRORS WIND	24 HOUR FORECAST POSIT		24 HOUR FORECAST WIND	24 HOUR ERRORS DST	24 HOUR ERRORS WIND	48 HOUR FORECAST POSIT		48 HOUR FORECAST WIND	48 HOUR ERRORS DST	48 HOUR ERRORS WIND	72 HOUR FORECAST POSIT		72 HOUR FORECAST WIND	72 HOUR ERRORS DST	72 HOUR ERRORS WIND
082600Z	8.2	146.0	20	0.0	0.0	0	-0	0	0.0	0.0	0	-0	0	0.0	0.0	0	-0	0	0.0	0.0	0	-0	0
082606Z	8.8	145.9	20	0.0	0.0	0	-0	0	0.0	0.0	0	-0	0	0.0	0.0	0	-0	0	0.0	0.0	0	-0	0
082612Z	9.4	145.8	25	0.0	0.0	0	-0	0	0.0	0.0	0	-0	0	0.0	0.0	0	-0	0	0.0	0.0	0	-0	0
082618Z	10.2	145.5	30	0.0	0.0	0	-0	0	0.0	0.0	0	-0	0	0.0	0.0	0	-0	0	0.0	0.0	0	-0	0
082700Z	10.8	144.9	35	10.8	145.1	30	12	-5	13.5	143.7	45	67	-15	15.9	141.5	60	227	-10	17.8	138.8	75	411	15
082706Z	11.4	144.4	40	11.4	144.6	40	12	0	14.0	143.0	60	74	0	16.3	140.1	70	248	0	17.7	136.2	80	429	20
082712Z	11.9	143.9	50	11.9	143.8	45	6	-5	14.1	141.7	65	61	5	16.5	138.3	85	273	20	18.3	134.1	90	491	25
082718Z	12.5	143.3	60	12.5	143.2	50	6	-10	14.9	140.6	70	139	10	17.0	137.2	85	333	25	19.1	133.0	95	546	30
082800Z	13.2	142.6	60	13.1	142.5	60	8	0	15.4	139.6	70	190	0	18.0	136.3	80	430	20	20.2	132.3	90	618	20
082806Z	13.6	141.8	60	13.7	141.8	60	6	0	16.1	138.8	70	239	0	18.7	135.0	80	501	20	20.6	130.3	90	659	10
082812Z	13.2	141.2	60	14.2	140.9	60	62	0	16.5	137.8	75	279	10	18.9	134.0	80	527	15	20.7	129.3	90	668	5
082818Z	12.6	140.9	60	13.5	140.0	60	75	0	14.8	136.6	75	222	15	16.2	132.8	80	385	15	18.0	128.1	90	526	-5
082900Z	12.3	140.3	70	12.2	140.3	70	6	0	12.3	138.4	90	83	30	13.7	136.5	100	249	30	16.1	134.7	110	494	5
082906Z	12.2	139.6	70	12.2	139.9	70	18	0	12.7	137.3	90	127	30	14.4	134.6	100	275	20	17.0	131.6	110	500	-5
082912Z	12.0	139.0	65	12.1	139.0	70	6	5	12.9	136.1	90	150	25	14.7	132.9	105	292	20	17.4	129.3	115	502	-10
082918Z	11.6	138.5	60	12.0	138.8	65	30	5	12.4	136.6	80	144	15	13.9	133.8	90	316	-5	16.2	130.3	105	472	-10
083000Z	11.0	137.9	60	11.0	137.9	60	0	0	10.6	134.6	70	32	0	12.0	129.9	85	146	-20	13.7	125.3	100	239	5
083006Z	10.6	137.1	60	10.6	137.0	60	6	0	10.6	133.6	70	40	-10	11.7	129.3	85	155	-30	12.9	124.6	100	182	25
083012Z	10.4	136.3	65	10.5	136.3	65	6	0	10.7	132.9	75	67	-10	11.7	129.0	85	189	-40	13.1	124.7	100	210	35
083018Z	10.3	135.4	65	10.4	135.4	65	6	0	10.5	131.9	80	89	-15	11.3	128.0	95	168	-20	12.7	123.3	110	149	55
083100Z	10.1	134.4	70	10.2	134.4	70	6	0	10.4	130.6	95	81	-10	12.0	126.0	115	169	20	14.2	120.5	90	121	45
083106Z	10.0	133.3	80	10.3	133.5	80	22	0	10.7	129.4	105	109	-10	12.7	124.0	105	156	30	15.3	118.8	85	148	30
083112Z	9.9	132.1	85	10.1	132.1	85	12	0	11.0	127.2	110	99	-15	13.2	121.9	90	144	25	15.5	117.5	75	115	10
083118Z	9.6	130.7	95	9.8	130.7	90	12	-5	10.4	125.0	115	51	0	12.5	119.8	90	109	35	15.3	115.4	95	126	20
090100Z	9.6	129.5	105	9.7	129.[illegible]	100	8	-5	10.7	124.1	110	48	15	13.0	119.0	85	90	40	16.1	115.1	85	93	0
090106Z	9.4	128.1	115	9.5	128.1	115	6	0	10.4	122.2	90	48	15	13.4	117.3	85	126	30	17.3	114.4	85	102	-5
090112Z	9.4	126.8	125	9.4	126.8	125	0	0	11.6	121.3	100	63	35	16.2	117.4	95	155	30	21.0	113.4	95	263	-5
090118Z	9.8	125.6	115	9.6	125.5	115	13	0	11.3	121.5	100	18	45	14.4	116.8	90	35	15	18.7	112.1	85	95	-30
090200Z	9.9	124.1	95	10.0	124.1	100	6	5	11.8	119.6	75	48	30	14.8	116.2	90	27	5	18.4	112.9	100	40	0
090206Z	10.3	123.0	75	10.4	122.7	85	19	10	12.5	118.1	80	80	25	15.4	115.2	90	32	0	18.6	112.7	100	92	20
090212Z	10.8	122.0	65	10.8	121.8	80	12	15	12.8	117.8	85	69	20	15.5	114.2	90	72	-10	18.8	110.9	100	83	30
090218Z	11.3	121.2	55	11.0	121.3	80	19	25	13.3	117.5	85	72	10	16.3	113.5	90	74	-25	19.6	109.7	100	74	40
090300Z	12.2	120.3	45	12.0	120.4	50	13	5	14.5	116.9	75	51	-10	17.5	112.9	85	62	-15	20.3	108.8	85	78	35
090306Z	12.9	119.4	55	12.6	119.4	55	18	0	15.2	115.9	80	51	-10	18.1	111.9	90	77	10	21.4	107.5	75	72	35
090312Z	13.8	118.4	65	13.8	118.5	65	6	0	17.2	114.7	90	38	-10	20.6	110.5	70	31	0	23.8	106.6	35	63	5
090318Z	14.5	117.4	75	14.4	117.4	75	6	0	17.8	113.3	100	19	-15	21.2	109.0	65	33	5	0.0	0.0	0	-0	0
090400Z	15.2	116.4	85	15.1	116.5	85	8	0	18.3	112.4	75	11	-25	21.8	108.1	50	46	0	0.0	0.0	0	-0	0
090406Z	15.9	115.4	90	16.0	115.5	90	8	0	19.3	111.1	70	8	-10	22.9	107.2	35	50	-5	0.0	0.0	0	-0	0
090412Z	16.7	114.3	100	16.7	114.4	95	6	-5	19.9	110.3	70	13	0	23.9	107.4	30	61	0	0.0	0.0	0	-0	0
090418Z	17.5	113.2	115	17.5	113.2	115	0	0	21.0	109.2	75	16	15	0.0	0.0	0	-0	0	0.0	0.0	0	-0	0
090500Z	18.3	112.2	100	18.4	112.2	110	6	10	21.9	108.6	70	25	20	0.0	0.0	0	-0	0	0.0	0.0	0	-0	0
090506Z	19.2	111.2	80	19.3	111.2	80	6	0	23.0	108.2	30	32	-10	0.0	0.0	0	-0	0	0.0	0.0	0	-0	0
090512Z	20.1	110.4	70	20.2	110.2	70	13	0	23.9	107.8	30	68	0	0.0	0.0	0	-0	0	0.0	0.0	0	-0	0
090518Z	20.8	109.4	60	21.0	109.2	65	16	5	0.0	0.0	0	-0	0	0.0	0.0	0	-0	0	0.0	0.0	0	-0	0
090600Z	21.6	108.9	50	21.8	108.8	50	13	0	0.0	0.0	0	-0	0	0.0	0.0	0	-0	0	0.0	0.0	0	-0	0
090606Z	22.5	108.0	40	22.3	108.0	40	12	0	0.0	0.0	0	-0	0	0.0	0.0	0	-0	0	0.0	0.0	0	-0	0
090612Z	22.9	107.2	30	0.0	0.0	0	-0	0	0.0	0.0	0	-0	0	0.0	0.0	0	-0	0	0.0	0.0	0	-0	0

	ALL FORECASTS WRNG	24-HR	48-HR	72-HR	TYPHOONS WHILE OVER 35 KTS WRNG	24-HR	48-HR	72-HR
AVG FORECAST POSIT ERROR	13	80	179	279	13	80	182	287
AVG RIGHT ANGLE ERROR	10	63	149	242	10	63	149	242
AVG INTENSITY MAGNITUDE ERROR	3	14	17	19	3	14	18	20
AVG INTENSITY BIAS	1	5	7	15	1	5	7	15
NUMBER OF FORECASTS	42	39	35	31	42	38	34	30

DISTANCE TRAVELED BY TROPICAL CYCLONE IS 2806. NM

AVERAGE SPEED OF TROPICAL CYCLONE IS 10 KNOTS

TYPHOON IKE
FIX POSITIONS FOR CYCLONE NO. 13

SATELLITE FIXES

FIX NO.	TIME (Z)	FIX POSITION	ACCRY	DVORAK CODE	COMMENTS	SITE
1	260000	8.2N 146.0E	PCN 6	T0.0/0.0	INIT OBS	PGTW
2	260617	8.8N 145.7E	PCN 5			PGTW
3	261800	9.6N 145.2E	PCN 6	T1.0/1.0	INIT OBS	PGTW
4	262050	10.5N 145.3E	PCN 3			PGTW
5	262131	10.4N 145.4E	PCN 3			PGTW
6	270019	10.9N 145.0E	PCN 5	T2.0/2.0 /D2.0/24HRS		PGTW
7	270605	11.4N 144.4E	PCN 5			PGTW
8	270930	11.0N 144.5E	PCN 6			PGTW
9	271200	12.0N 143.9E	PCN 6	T3.0/3.0	INIT OBS ULCC 11.0N 143.7E	PGTW
10	271300	11.9N 143.8E	PCN 6			PGTW
11	271800	12.5N 143.2E	PCN 6			PGTW
12	271850	12.4N 142.9E	PCN 6		ULCC FIX	PGTW
13	272029	12.8N 142.5E	PCN 6		ULCC FIX	PGTW
14	272359	13.0N 142.3E	PCN 3	T3.5/3.5 /D1.5/24HRS		PGTW
15	280909	13.6N 141.2E	PCN 5			PGTW
16	281200	13.4N 140.8E	PCN 6	T3.5/3.5 /D0.5/24HRS		PGTW
17	281240	13.1N 140.7E	PCN 6		ULCC FIX	PGTW
18	281837	13.2N 140.3E	PCN 6		ULCC FIX	PGTW
19	282008	12.0N 140.0E	PCN 6		ULCC FIX	PGTW
20	290120	12.2N 140.4E	PCN 3	T3.5/3.5+/S0.0/25HRS		PGTW
21	290540	12.2N 139.9E	PCN 3			PGTW
22	290540	11.2N 139.4E	PCN 5			RODN
23	290921	11,9N 139.6E	PCN 5			PGTW
24	291219	12.3N 139.2E	PCN 5	T3.5/3.5-/S0.0/24HRS		PGTW
25	291825	11.8N 138.8E	PCN 6			PGTW
26	291825	12.2N 138.3E	PCN 5		ULCC FIX	RODN
27	292128	11.8N 138.2E	PCN 6			PGTW
28	292159	11.6N 137.9E	PCN 6			PGTW
29	300100	11.4N 137.7E	PCN 5	T3.5/3.5+/S0.0/24HRS		PGTW
30	300709	10.6N 136.9E	PCN 4		FRMG EYEWALL	PGTW
31	301008	10.5N 136.7E	PCN 4		FRMG EYEWALL	PGTW
32	301038	10.5N 136.4E	PCN 4			PGTW
33	301200	10.6N 136.4E	PCN 6	T4.5/4.5 /D1.0/24HRS		PGTW
34	301812	10.3N 135.3E	PCN 4		FRMG EYEWALL	PGTW
35	302107	10.3N 134.9E	PCN 3		FRMG EYEWALL W-S-E	PGTW
36	310040	10.2N 134.2E	PCN 4			PGTW
37	310657	10.4N 133.3E	PCN 2	T5.0/5.0 /D1.5/30HRS	EYE FIX	PGTW
38	310947	9.9N 132.4E	PCN 2			PGTW
39	311013	10.0N 132.3E	PCN 3			PGTW
40	311320	9.9N 131.6E	PCN 1		EYE DIA 12NM	PGTW
41	311800	9.6N 130.6E	PCN 4			PGTW
42	311941	9.6N 130.3E	PCN 1	T6.0/6.0 /D1.5/32HRS		PGTW
43	312045	9.6N 130.0E	PCN 1			PGTW
44	312252	9.7N 129.7E	PCN 1		EYE DIA 9NM	PGTW
45	010201	9.7N 129.1E	PCN 1			PGTW
46	010201	9.7N 129.1E	PCN 1	T6.0/6.0-	INIT OBS	RPMK
47	010600	9.5N 128.0E	PCN 2			PGTW
48	010644	9.5N 128.0E	PCN 2	T5.5/5.5-/D0.5/24HRS		PGTW
49	010925	9.3N 127.4E	PCN 4			PGTW
50	011200	9.4N 126.8E	PCN 2		EYE DIA 12NM	PGTW
51	011442	9.7N 126.5E	PCN 3			RPMK
52	011800	9.5N 125.5E	PCN 4			PGTW
53	011929	9.9N 125.1E	PCN 3	T5.0/6.0+/W1.0/24HRS		PGTW
54	012205	9.9N 124.4E	PCN 3	T5.0/6.0-/W1.0/20HRS		RPMK

55	012228	9 9N 124 4E	PCN 3			PGTW
56	020000	9 9N 124 1E	PCN 4			PGTW
57	020141	10 1N 123 6E	PCN 4			PGTW
58	020600	10 7N 122 7E	PCN 6	T4 5/5 5+/W1 0/23HRS		PGTW
59	020814	10 5N 122 3E	PCN 3	T4 5/5 5+/W1 5/26HRS		RPMK
60	021045	10 3N 121 5E	PCN 4			RPMK
61	021106	10 2N 121 9E	PCN 6			RODN
62	021421	11 0N 121 8E	PCN 4			PGTW
63	021916	10 8N 121 4E	PCN 6	T3 5/4 5+/W1 5/24HRS		PGTW
64	022144	12 2N 120 5E	PCN 4			PGTW
* 65	022344	12 5N 121 1E	PCN 3	T4 5/4 5	INTI OBS	RODN
66	022345	12 0N 120 7E	PCN 3	T4 5/5 0+/W1 0/26HRS		RPMK
67	030121	12 3N 119 9E	PCN 3			PGTW
68	030121	12 2N 119 8E	PCN 3			RPMK
69	030246	15 1N 116 9E	PCN 3			RPMK
70	030600	12 9N 119 5E	PCN 2	T5 0/5 5 /D0 5/24HRS		PGTW
71	030801	13 1N 119 2E	PCN 1	T4 5/5 0+/S0 0/24HRS	EYE FIX	RPMK
* 72	030801	13 2N 120 4E	PCN 3			RODN
73	031024	13 5N 118 9E	PCN 1			PGTW
74	031042	13 5N 118 9E	PCN 4		ULCC FIX	PGTW
75	031200	13 8N 118 5E	PCN 2		EYE FIX	PGTW
76	031401	14 0N 118 1E	PCN 2			PGTW
77	031800	14 4N 117 3E	PCN 2	T5 5/5 5	INIT OBS EYE FIX	PGTW
78	032304	15 0N 116 8E	PCN 4			RODN
79	032320	15 0N 116 4E	PCN 3			PGTW
80	032320	15 2N 116 3E	PCN 3	T5 0/5 0 /D0 5/24HRS		RPMK
81	040242	15 6N 116 2E	PCN 3			RPMK
82	040600	16 1N 115 5E	PCN 2	T5 5/5 5 /D0 5/24HRS		PGTW
83	040748	16 2N 115 1E	PCN 1	T5 5/5 5	INIT OBS	RODN
84	041003	16 5N 114 8E	PCN 2			PGTW
85	041158	17 2N 114 4E	PCN 2			RODN
86	041159	16 8N 114 8E	PCN 2			RPMK
87	041200	16 8N 114 3E	PCN 2		EYE DIA 25NM	PGTW
* 88	041523	17 6N 114 9E	PCN 2			RPMK
89	041800	17 5N 113 1E	PCN 2	T6 5/6 5-/D1 0/24HRS		PGTW
90	042033	17 8N 112 6E	PCN 1			RODN
91	042243	18 0N 112 7E	PCN 1			RODN
92	050000	18 4N 112 0E	PCN 2		EYE DIA 12NM	PGTW
93	050037	18 2N 112 4E	PCN 3	T5 5/5 5-/D0 5/25HRS		RPMK
94	050222	18 5N 111 9E	PCN 3			RPMK
95	050600	19 3N 111 5E	PCN 4	T3 5/3 5	INIT OBS	PGTW
96	050736	19 3N 111 2E	PCN 3	T4 5/4 5	INIT OBS	RSKO
97	051134	18 3N 110 7E	PCN 4		ULCC 19 4N 109.4E	RODN
98	051134	20 1N 110 5E	PCN 3			RPMK
99	051200	20 0N 110 6E	PCN 6			PGTW
100	051502	20 2N 110 1E	PCN 4			RODN
101	051800	20 9N 109 3E	PCN 4	T4 0/5.0-/W2.5/24HRS		PGTW
102	052021	20 9N 109 1E	PCN 4			RSKO
103	060000	21 6N 109 0E	PCN 6			PGTW
104	060013	21 8N 108 6E	PCN 3			RPMK
105	060013	21 8N 109 0E	PCN 3			RODN
106	060724	22 4N 107 8E	PCN 3			PGTW
107	061102	22 5N 107.3E	PCN 4			PGTW
108	061102	22 5N 107 3E	PCN 4			RSKO
109	061110	22 5N 107 2E	PCN 5			RPMK
110	061200	22 6N 106 8E	PCN 6			PGTW

AIRCRAFT FIXES

FIX NO	TIME (Z)	FIX POSITION	FLT LVL	700MB HGT	OBS MSLP	MAX-SFC-WND VEL/BRG/RNG	MAX-FLT-LVL-WND DIR/VEL/BRG/RNG	ACCRY NAV/MET	EYE SHAPE	EYE DIAM/ORIENTATION	EYE TEMP (C) OUT/ IN/ DP/SST	MSN NO.
1	270510	11 3N 144 5E	1500FT		997	35 330 17	060 42 330 17	9 2			+26 +25	1
2	270713	11 4N 144 2E	1500FT		999	50 120 40	220 51 120 40	8 1			+24 +25	1
3	272120	12 8N 142 6E	1500FT		997	50 040 20	010 54 320 23	6 2			+23 +24 +24 28	2
4	280007	13 2N 142 4E	700MB	3077		65 140 20	310 61 240 6	10 2				2
5	280531	13 7N 141 8E	700MB			60 110 10	210 56 110 12	10 1			+14 + 8	3
6	280844	13 7N 141 6E	700MB			25 290 60	340 34 280 50	8 1	CIRCULAR	5	+10 +11 + 6	3
7	282111	12 4N 140 7E	1500FT		990	65 210 30	250 65 210 30	7 5				4
8	282341	12 3N 140 4E	1500FT		991	75 140 11	170 75 090 10	5 5	CIRCULAR	20	+26 +25 +23 30	4
9	290845	12 1N 139 5E	700MB	2971		45 090 35	150 51 080 39	5 5			+ 9 +16 + 7	6
10	291118	12 1N 139 0E	700MB	3006	989		220 48 140 55	8 3	CIRCULAR	20	+10 +15 + 9	6
11	292035	11 3N 138 3E	700MB	2969	985		140 66 070 15	10 1	CIRCULAR	25	+ 8 +15 +10	7
12	292322	11 0N 138 0E	700MB	2978		60 140 15	190 48 120 25	10 1	ELLIPTICAL	30 25 030	+10 +17 +10	7
13	300917	10 7N 136 7E	700MB	2932		50 120 40	090 84 350 30	9 2	ELLIPTICAL	45 30 180	+11 +16 +10	9
14	301120	10 6N 136 4E	700MB	2915			340 71 240 30	12 2	ELLIPTICAL	45 35 050	+ 9 +16 +10	9
15	302040	10 1N 135 0E	700MB	2872	973		040 87 310 30	7 5				10
16	302310	10 2N 134 6E	700MB	2851		75 120 30	180 77 120 10					10
17	310837	10 1N 132 8E	700MB	2775	961	85 080 10	040 110 320 21	5 3	ELLIPTICAL	25 20 170	+12 +18 + 7	12
18	311111	9 9N 132 2E	700MB	2757	960		280 68 190 15	15 2	CIRCULAR	18	+ 9 +18 + 8	12
19	312356	9 7N 129 6E	700MB	2670	953	100 300 30	030 102 290 22	10 5	CIRCULAR	15	+10 +20 +18	13
20	010246	9 5N 128 8E	700MB	2656		120 360 15	250 74 140 15	6 5			+ 9 +19 +11	13
21	010845	9 4N 127 7E	700MB	2630	947	130 040 12	100 117 040 12	7 2	CIRCULAR	25	+12 +16 +12	14
22	011118	9 3N 126 9E	700MB	2651	949		080 103 030 17	7 5	CIRCULAR	30	+ 9 +21 +12	14
23	011222	9 4N 126 7E	700MB	2659	951		070 110 350 10	8 5	CIRCULAR	25	+10 +16 +13	14
24	021144	10 9N 122 0E	700MB	3063			360 69 280 14	7 7			+ 8 + 6 + 6	15
25	021417	10 9N 121 8E	700MB	3042			130 64 020 30	7 7			+ 9 +10 +10	15
26	022055	12 0N 120 8E	700MB	2986	990		020 41 280 36	4 5	CIRCULAR	35	+10 +15 + 6	16
27	022339	12 0N 120 4E	700MB	3022	992	45 150 30	210 47 150 38	4 5	CIRCULAR	40	+11 +15 + 7	16
28	030843	13 2N 119 1E	700MB	2962		65 040 30	110 68 040 27	7 7	CIRCULAR	30	+13 +13 + 7	17
29	031132	13 8N 118 4E	700MB	2978	989		080 65 100 21	7 6			+15 + 8	17
30	032033	14 7N 116 4E	700MB	2937	984		040 66 340 16	10 6	CIRCULAR	20	+10 +12	18
31	032338	15 1N 116 5E	700MB	2913	981	70 030 15	130 90 030 32	8 6	CIRCULAR	20	+10 +12 +10 24	18
32	040839	16 3N 115 1E	700MB	2789	965	80 010 15	090 88 020 14	12 8	CIRCULAR	20	+12 +16	19
33	041112	16 6N 114 5E	700MB	2747	961	50 100 105	100 99 360 18	13 5	CIRCULAR	20	+18 +17 + 6	19

RADAR FIXES

FIX NO	TIME (Z)	FIX POSITION	RADAR	ACCRY	EYE SHAPE	EYE DIAM	RADOB-CODE ASWAR TDDFF	COMMENTS	RADAR POSITION	SITE WMO NO
1	270735	11 4N 144 5E	LAND	POOR					13 6N 144 9E	91218
2	270935	11 4N 144 5E	LAND	POOR					13 6N 144 9E	91218
3	271043	11 4N 144 5E	LAND	POOR				MOV 1805	13 6N 144 9E	91218
4	271235	11 6N 143 7E	LAND	POOR				MOV 0608	13 6N 144 9E	91218
5	271335	11 6N 143 5E	LAND	FAIR	CIRCULAR			MOV 0810 EYE OPN ERN QUADS	13 6N 144 9E	91218
6	271435	12 5N 143 1E	LAND	POOR					13 6N 144 9E	91218
7	271835	11 0N 142 7E	LAND	POOR					13 6N 144 9E	91218
8	272155	11 7N 142 8E	LAND	POOR					13 6N 144 9E	91218
9	011400	9 3N 126 5E	LAND				10801 42710		10 3N 124 0E	98646
10	011500	9 8N 126 3E	LAND				10611 42815		10 3N 124 0E	98646
11	011600	9 9N 126 1E	LAND				11891 42815		10 3N 124 0E	98646
12	011700	9 8N 125 7E	LAND				10482 42615		10 3N 124 0E	98646
13	011800	9 8N 125 5E	LAND				14382 42612		10 3N 124 0E	98646
14	030700	13 5N 118 6E	LAND				5//// 331//		14 8N 120 3E	98426
15	030800	13 2N 119 0E	LAND				5//// 331//		14 8N 120 3E	98426
16	030900	13 5N 118 8E	LAND				51670 53308		14 8N 120 3E	98426
17	031000	13 7N 118 7E	LAND				2258/ 43208		14 8N 120 3E	98426
18	031100	13 9N 118 6E	LAND				3564/ 43308		14 8N 120 3E	98426
19	031200	14 0N 118 6E	LAND				///// 43309		14 8N 120 3E	98426
20	031200	13 3N 118 7E	LAND				10502 42910		16 3N 120 6E	98321
21	031300	13 5N 118 4E	LAND				10612 42912		16 3N 120 6E	98321
22	031500	13 6N 118 0E	LAND				10763 42718		16 3N 120 6E	98321
23	041000	16 6N 114 7E	LAND				10426 53112		16 8N 112 3E	59981
24	041300	17 0N 114 0E	LAND				10315 53014		16 8N 112 3E	59981
25	041500	17 3N 113 6E	LAND				10316 53114		16 8N 112 3E	59981
26	041600	17 4N 113 4E	LAND				10315 53114		16 8N 112 3E	59981
27	041700	17 5N 113 2E	LAND				10315 53014		16 8N 112 3E	59981
28	041800	17 6N 113 0E	LAND				10315 53014		16 8N 112 3E	59981
29	041900	17 7N 112 3E	LAND				10315 53014		16 8N 112 3E	59981
30	042000	17 9N 112 6E	LAND				10314 53114		16 8N 112 3E	59981
31	050000	18 4N 112 0E	LAND				21434 53011		16 8N 112 3E	59981
32	050200	18 6N 111 6E	LAND				21414 53011		16 8N 112 3E	59981
33	050300	18 7N 111 5E	LAND				21414 53111		16 8N 112 3E	59981
34	050400	18 8N 111 3E	LAND				21464 53012		16 8N 112 3E	59981
35	050500	19 1N 111 1E	LAND				3//4 53214		16 8N 112 3E	59981
36	050600	19 2N 110 9E	LAND				3//54 53114		16 8N 112 3E	59981
37	050700	19 4N 110 8E	LAND				4///4 53214		16 8N 112 3E	59981
38	060100	21 7N 108 6E	LAND				21812 63211		16 8N 112 3E	59981

SYNOPTIC FIXES

FIX NO	TIME (Z)	FIX POSITION	INTENSITY ESTIMATE	NEAREST DATA (NM)	COMMENTS
1	051200	20 2N 110 2E	070	017	59758 59658 59355 59845
2	051800	21 0N 109 2E	065	010	59647 59644 59658 59632
3	060600	22 3N 108 0E	040	025	59431 59417

NOTICE - THE ASTERISKS (*) INDICATE FIXES UNREPRESENTATIVE AND NOT USED FOR BEST TRACK PURPOSES

TROPICAL STORM JUNE
BEST TRACK DATA

	BEST TRACK		WARNING		ERRORS		24 HOUR FORECAST		ERRORS		48 HOUR FORECAST		ERRORS		72 HOUR FORECAST		ERRORS	
MO/DA/HR	POSIT	WIND	POSIT	WIND	DST	WIND	POSIT	WIND	DST	WIND	POSIT	WIND	DST	WIND	POSIT	WIND	DST	WIND
082800Z	17.7 125.3	45	0.0 0 0	0	-0	0	0.0 0 0	0	-0	0	0 0 0 0	0	-0	0	0 0 0 0	0	-0	0
082806Z	17 9 124 2	45	17 9 124 5	45	17	0	19 2 121 6	55	117	5	21 0 118 2	70	45	10	0 0 0 0	0	-0	0
082812Z	17 9 122 9	55	18 0 124 0	50	63	-5	19 2 121 6	60	149	10	20 9 118 3	70	112	10	0 0 0 0	0	-0	0
082818Z	18 2 121 6	45	18 0 122 8	50	69	5	19 6 119 2	60	28	5	22 3 115 6	70	65	25	0 0 0 0	0	-0	0
082900Z	18 6 120.6	45	17 7 121 4	45	71	0	18 7 116 3	70	157	10	21 3 112 0	80	278	55	0 0 0 0	0	-0	0
082906Z	18 7 119.6	50	18 2 119 4	50	32	0	19 7 115 3	75	145	15	0 0 0 0	0	-0	0	0.0 0 0	0	-0	0
082912Z	18.9 119.0	50	18 5 118 7	50	29	0	20 5 114 8	70	131	10	0 0 0 0	0	-0	0	0 0 0 0	0	-0	0
082918Z	19.6 118 7	55	18 9 117 7	55	71	0	21 3 113 6	75	189	30	0 0 0 0	0	-0	0	0 0 0 0	0	-0	0
083000Z	20 4 118 4	60	20 9 118 8	60	37	0	24 6 116 8	40	53	15	0 0 0 0	0	-0	0	0 0 0 0	0	-0	0
083006Z	21.1 117.4	60	21 9 117 4	60	48	0	0 0 0 0	0	-0	0	0 0 0 0	0	-0	0	0 0 0 0	0	-0	0
083012Z	21 9 116.6	60	24 1 115.2	40	153	-20	0 0 0 0	0	-0	0	0 0 0.0	0	-0	0	0 0 0.0	0	-0	0
083018Z	23 1 116.4	45	25 3 114 3	25	175	-20	0 0 0 0	0	-0	0	0.0 0 0	0	-0	0	0.0 0.0	0	-0	0
083100Z	24 1 116.0	25	0 0 0 0	0	-0	0	0 0 0 0	0	-0	0	0.0 0.0	0	-0	0	0 0 0 0	0	-0	0

	ALL FORECASTS WRNG	24-HR	48-HR	72-HR	TYPHOONS WHILE OVER 35 KTS WRNG	24-HR	48-HR	72-HR
AVG FORECAST POSIT ERROR	70	121	125	0	0	0	0	0
AVG RIGHT ANGLE ERROR	28	104	85	0	0	0	0	0
AVG INTENSITY MAGNITUDE ERROR	5	13	25	0	0	0	0	0
AVG INTENSITY BIAS	-4	13	25	0	0	0	0	0
NUMBER OF FORECASTS	11	8	4	0	0	0	0	0

DISTANCE TRAVELED BY TROPICAL CYCLONE IS 738 NM

AVERAGE SPEED OF TROPICAL CYCLONE IS 10 KNOTS

TROPICAL STORM JUNE
FIX POSITIONS FOR CYCLONE NO. 14

SATELLITE FIXES

FIX NO.	TIME (Z)	FIX POSITION	ACCRY	DVORAK CODE	COMMENTS	SITE
1	250630	18 1N 136 3E	PCN 6	T0 5/0.5	INIT OBS	PGTW
2	250916	18 1N 136 0E	PCN 6		ULCC FIX	PGTW
3	260617	19 7N 133 0E	PCN 5	T0 0/0 5 /W0 5/24HRS		PGTW
4	270201	19 6N 126 3E	PCN 5			PGTW
5	270605	18 1N 128.8E	PCN 5	T1 0/1 0 /D1 0/24HRS		PGTW
6	271200	18 4N 129 4E	PCN 6	T1.0/1 0	INIT OBS ULCC FIX	PGTW
7	271800	19 0N 128 9E	PCN 6		ULCC FIX	PGTW
8	271850	19 2N 128 8E	PCN 6		ULCC FIX	PGTW
9	272247	19.4N 126 1E	PCN 6		ULCC FIX	PGTW
10	280141	17 4N 124 5E	PCN 5			PGTW
* 11	280141	18 0N 123 8E	PCN 5	T2 5/2.5	INIT OBS	RPMK
12	280734	18 3N 124 6E	PCN 5	T2 5/2.5 /D1.5/25HRS		PGTW
13	280734	17 5N 124 4E	PCN 5			RPMK
14	280734	18 0N 125 1E	PCN 5	T2 5/2.5		RODN
15	281126	17 8N 123 5E	PCN 5			RPMK
16	281126	17 8N 123 0E	PCN 6			RODN
* 17	281200	18 1N 124 1E	PCN 6	T2 5/2.5 /D1 5/24HRS		PGTW
18	281421	17 7N 122 9E	PCN 6		ULCC FIX	PGTW
19	281800	17 5N 122 4E	PCN 6		ULCC FIX	PGTW
* 20	282019	17 5N 122 4E	PCN 5			RPMK
21	282019	17 9N 120 4E	PCN 5			RODN
* 22	282149	17 5N 121 6E	PCN 5	T3 0/3 0 /D0 5/20HRS		RPMK
* 23	282149	17 2N 121 7E	PCN 6			PGTW
24	290004	18 2N 119 7E	PCN 5			RODN
25	290005	17 7N 121 0E	PCN 5	T3 5/3 5-/D1 0/22HRS		RPMK
26	290120	18 2N 120 2E	PCN 5			PGTW
27	290722	18 1N 118 5E	PCN 5	T3 5/3 5 /D1 0/24HRS		PGTW
* 28	291029	18 0N 118.2E	PCN 6			PGTW
29	291102	18 5N 118 8E	PCN 5			RPMK
30	291401	18 9N 118 2E	PCN 6			PGTW
* 31	291800	19 0N 117 7E	PCN 6	T3 0/3 0 /D0 5/30HRS		PGTW
* 32	292128	19 4N 117 4E	PCN 6			PGTW
33	292340	21 1N 118 8E	PCN 3			RPMK
* 34	300242	18 5N 117 3E	PCN 6		ULCC FIX	RPMK
* 35	300709	22 7N 116 3E	PCN 4	T2 5/3 5-/W1 0/24HRS		PGTW
36	301008	23 8N 115 6E	PCN 6			PGTW
37	301200	24 2N 115 2E	PCN 6			PGTW
38	302316	23 5N 116 1E	PCN 5			RPMK
39	302316	23 4N 116 1E	PCN 6			PGTW
40	302316	23 0N 115 3E	PCN 5	T2 5/2 5	INIT OBS	RODN
41	310221	23 7N 115 3E	PCN 5			RODN
42	310839	24 7N 114 7E	PCN 5			RPMK
43	311013	25 9N 115 0E	PCN 5			PGTW
44	311127	24 1N 119 4E	PCN 5			RODN
45	311155	25 5N 114 4E	PCN 5			RPMK
46	311502	26 0N 114 5E	PCN 5			RSKO

AIRCRAFT FIXES

FIX NO	TIME (Z)	FIX POSITION	FLT LVL	700MB HGT	OBS MSLP	MAX-SFC-WND VEL/BRG/RNG	MAX-FLT-LVL-WND DIR/VEL/BRG/RNG	ACCRY NAV/MET	EYE SHAPE	EYE ORIEN- DIAM/TATION	EYE TEMP (C) OUT/ IN/ DP/SST	MSN NO
1	270651	17 5N 129 7E	1500FT		993	30 220 90	260 35 270 149	7 15			+26 +24 +24 27	1
2	272341	17 5N 124 9E	1500FT		990	45 150 65	250 50 150 65	13 1			+25 +25	2
3	280540	18 0N 124 6E	1500FT		986	45 080 100	170 35 080 100	10 20				3
4	280820	17 9N 124 2E	1500FT		986	55 230 65	040 44 310 100	10 10			+26 +26	3
5	290627	18 2N 119 3E	700MB	2972		50 180 30	250 42 180 30	10 10				4
6	290838	18 7N 119 6E	1500FT		986	40 300 70	250 60 160 30	10 10			+26 +25	4
7	292305	20 7N 118 9E	700MB	2939	983	65 080 60	210 45 130 90	6 7			+13 +14 +12	5

RADAR FIXES

FIX NO	TIME (Z)	FIX POSITION	RADAR	ACCRY	EYE SHAPE	EYE DIAM	RADOB-CODE ASWAR TDDFF	COMMENTS	RADAR POSITION	SITE WMO NO
* 1	281200	17 1N 122 6E	LAND				20351 73418		18 4N 121 6E	98231
2	301000	21 4N 116 9E	LAND				7//4 73007		23 4N 116 7E	59316
3	301100	21 4N 116 8E	LAND				7//4 43008		23 4N 116 7E	59316
4	301200	21 5N 116 8E	LAND				6//3 53008		23 4N 116 7E	59316
5	301200	21 7N 116 6E	LAND				55/// /////		22 3N 114 2E	45005
6	301300	21 6N 116 6E	LAND				557// /////		22 3N 114 2E	45005
7	301400	21 6N 116 6E	LAND				55/// /////		22 3N 114 2E	45005
8	301500	22 4N 116 2E	LAND				55/7/ 73318		22 3N 114 2E	45005
9	301600	22 3N 116 1E	LAND				55/7/ 73318		22 3N 114 2E	45005
10	301700	22 5N 116 1E	LAND				2091/ 73318		22 3N 114 2E	45005
* 11	301800	22 5N 116 0E	LAND				55/7/ 83310		22 3N 114 2E	45005
* 12	302000	22 8N 115 9E	LAND				25/// 73310		22 3N 114 2E	45005
13	302100	22 8N 115 7E	LAND				35/1/ /////		22 3N 114 2E	45005
* 14	302200	23 3N 115 1E	LAND				///// /////		22 3N 114 2E	45005

NOTICE - THE ASTERISKS (*) INDICATE FIXES UNREPRESENTATIVE AND NOT USED FOR BEST TRACK PURPOSES

TYPHOON KELLY
BEST TRACK DATA

	BEST TRACK			WARNING				24 HOUR FORECAST				48 HOUR FORECAST				72 HOUR FORECAST			
						ERRORS				ERRORS				ERRORS				ERRORS	
MO/DA/HR	POSIT		WIND	POSIT	WIND	DST	WIND	POSIT	WIND	DST	WIND	POSIT	WIND	DST	WIND	POSIT	WIND	DST	WIND
091300Z	22.4	171.5	25	0.0 0.0	0.	-0	0	0.0 0 0	0.	-0	0.	0.0 0 0	0	-0	0	0 0 0 0	0	-0	0
091306Z	21.9	170.8	25	0.0 0.0	0	-0	0	0.0 0 0	0.	-0	0.	0.0 0 0	0	-0	0	0 0 0 0	0	-0	0
091312Z	20.8	171.0	30	0.0 0 0	0	-0.	0	0 0 0 0	0	-0	0	0 0 0 0	0	-0	0	0 0 0 0	0	-0	0
091318Z	20.6	171.8	35	22.0 169.8	30.	140.	-5.	22.9 167.2	55.	271.	10	25.2 164.7	65	375	-5	28.9 163.0	75	219	0
091400Z	21.2	172.1	40	21.3 171.3	40	45.	0	21.6 169.9	60.	232.	10	23.2 166.5	70	436	0	25.9 162.2	85	411	15
091406Z	22.0	172.0	45	21.7 171.7	40.	25.	-5	22.3 170.6	60	250.	0	24.2 167.2	75	408	5	27.3 163.1	85	374	25
091412Z	22.9	172.0	45	21.7 171.8	45.	73.	0	22.8 170.8	65	300.	0	25.4 168.6	75	380	5	28.6 166.0	85	304	35
091418Z	23.9	172.0	45	23.7 171.6	45.	25.	0	28.1 170.8	65.	68.	-5.	31.5 169.1	80	174	5	33.9 167.9	90	32	50
091500Z	25.1	171.7	50	25.0 171.7	45	6	-5	29.2 170.2	60	99	-10	33.2 168.0	65	149	-5	36.4 166.8	65	126	30
091506Z	26.4	171.4	60	26.2 171.5	55	13.	-5	30.2 169.7	65	133.	-5	34.3 167.6	70	112	10	0 0 0 0	0	-0	0
091512Z	27.8	171.1	65	27.3 171.1	60.	30.	-5	31.5 169.5	70.	164.	0	35.7 168.1	70.	137	20	0 0 0 0	0	-0	0
091518Z	29.1	170.2	70	29.0 170.2	70	6.	0	35.4 167.7	75	243	0	41.2 170.4	60	422	20	0 0 0 0	0	-0	0
091600Z	30.2	168.7	70	30.2 168.9	70.	10	0	36.2 166.1	60.	243	-10	42.4 171.7	40	424	5	0 0 0 0	0	-0	0
091606Z	31.0	167.3	70	31.3 167.2	70	19	0	37.3 163.4	50	288	-10	0 0 0 0	0	-0.	0	0 0 0 0	0	-0	0
091612Z	31.4	166.3	70	31.5 166.5	65.	12.	-5.	34.5 162.9	50.	211.	0	0 0 0 0	0	-0	0	0 0 0 0	0	-0	0
091618Z	31.7	165.7	75	31.8 165.5	65	12	-10.	34.7 161.6	50.	322	10.	0 0 0 0	0	-0	0	0 0 0 0	0	-0	0
091700Z	32.2	165.3	70	32.1 165.1	55.	12	-15	33.7 163.0	35.	326	0	0.0 0 0	0	-0	0	0 0 0 0	0	-0	0.
091706Z	33.0	166.0	60	32.9 166.1	50.	8	-10	0.0 0.0	0.	-0	0.	0 0 0 0	0	-0	0	0 0 0 0	0	-0	0
091712Z	33.6	167.0	50	33.7 167.2	45.	12.	-5	0 0 0.0	0	-0	0.	0.0 0 0	0.	-0	0	0 0 0 0	0	-0	0
091718Z	34.4	168.1	40	34.7 168.6	40	31.	0.	0.0 0 0	0	-0	0.	0.0 0 0	0	-0	0	0.0 0.0	0	-0	0
091800Z	35.6	169.2	35	35.8 169.4	35.	15.	0.	0 0 0 0	0	-0	0.	0.0 0 0	0	-0.	0	0 0 0 0	0	-0	0

	ALL FORECASTS				TYPHOONS WHILE OVER 35 KTS			
	WRNG	24-HR	48-HR	72-HR	WRNG	24-HR	48-HR	72-HR
AVG FORECAST POSIT ERROR	27.	225	302.	244.	27.	225.	302.	244.
AVG RIGHT ANGLE ERROR	14.	121.	159.	201.	14.	121	159.	201.
AVG INTENSITY MAGNITUDE ERROR	4.	5.	8.	26.	4.	5.	8.	26
AVG INTENSITY BIAS	-4	-1.	6.	26.	-4.	-1.	6.	26.
NUMBER OF FORECASTS	18	14	10	6	18	14	10	6

DISTANCE TRAVELED BY TROPICAL CYCLONE IS 1297. NM

AVERAGE SPEED OF TROPICAL CYCLONE IS 11. KNOTS

TYPHOON KELLY
FIX POSITIONS FOR CYCLONE NO 15

SATELLITE FIXES

	FIX NO	TIME (Z)	FIX POSITION	ACCRY	DVORAK CODE	COMMENTS	SITE
*	1	121200	21 5N 173 3E	PCN 6	T1 0/1.0	INIT OBS	PGTW
	2	122158	22 6N 171 5E	PCN 4	T1 5/1 5	INIT OBS EXP LLCC	KGWC
	3	130000	22 4N 171 5E	PCN 4	T2 0/2 0	INIT OBS EXP LLCC	PGTW
	4	130600	22 1N 171 0E	PCN 6			PGTW
	5	130651	22 6N 170 7E	PCN 4		EXP LLCC ULAC 21 7N 171 5E	KGWC
*	6	131039	22 5N 170 4E	PCN 6		ULAC 21 3N 171 5E	KGWC
	7	131200	20 5N 172 0E	PCN 6			PGTW
*	8	131658	21 6N 169 4E	PCN 6		ULAC 20 6N 172 6E	KGWC
	9	131800	20 4N 172 3E	PCN 6	T2 5/2.5 /D1 5/24HRS		PGTW
*	10	132138	21 8N 170 4E	PCN 4	T2 5/2 5 /D1 0/24HRS	ULAC 21 0N 172 8E	KGWC
	11	140000	21 2N 172 5E	PCN 6			PGTW
	12	140401	21 9N 173 0E	PCN 6		ULAC 22 0N 173 3E	KGWC
	13	140600	22 0N 172 3E	PCN 6	T3 0/3 0 /D1 0/30HRS		PGTW
	14	140630	22 3N 171 6E	PCN 6		ULAC 22 5N 172 2E	KGWC
	15	140756	21 7N 172 5E	PCN 6		ULCC FIX	PGTW
	16	141018	22 3N 171 8E	PCN 6		ULAC 22 5N 173 0E	KGWC
	17	141645	23 2N 172 4E	PCN 6		ULAC 23 6N 172 1E	KGWC
	18	141800	23 2N 172 4E	PCN 6	T3 5/3 5 /D1 0/24HRS		PGTW
	19	141910	24 3N 172 0E	PCN 2		ULAC 24 4N 172 4E	KGWC
	20	141911	24 2N 172 2E	PCN 6		ULCC FIX	PGTW
	21	142035	24 1N 172 1E	PCN 6		ULCC FIX	PGTW
	22	142259	24 8N 172 4E	PCN 6	T3 5/3 5 /D1 0/25HRS		KGWC
	23	142300	24 7N 171 8E	PCN 3	T3 0 3 0 /S0 0/17HRS		PGTW
	24	150348	25 6N 171 6E	PCN 2			KGWC
	25	150600	26 3N 171 3E	PCN 4			PGTW
	26	150750	26 4N 171 2E	PCN 6		ULAC 26 5N 171 6E	KGWC
*	27	151139	27 0N 171 5E	PCN 2			KGWC
	28	151200	27 3N 171 1E	PCN 6			PGTW
	29	151633	[illegible]	PCN 2			KGWC
	30	151800	[illegible] 170 5E	PCN 4	T3 5/3 5-/S0 0/24HRS		PGTW
*	31	151849	[illegible] 4N 170 8E	PCN [illegible]			KGWC
	32	152239	30 4N 169 1E	PCN 2	T4 0/4 0 /D0 5/24HRS		KGWC
	33	160000	30 2N 168 8E	PCN 6	T3 5/3 5- D0 5/25HRS		PGTW
	34	160600	31 5N 167 4E	PCN 4			PGTW
	35	160729	31 0N 167 1E	PCN 4		ULAC 31 7N 167 5E	KGWC
	36	161119	31 2N 166 7E	PCN 6		ULAC 31 2N 166 5E	KGWC
	37	161200	31 4N 167 4E	PCN 6	T3 0/3 5 /W0 5/18HRS	ULCC 31 6N 166 8E	PGTW
	38	161600	32 2N 166 0E	PCN 2			KGWC
	39	161800	31 7N 165 7E	PCN 6		ULCC 32 2N 165 7E	PGTW
	40	161822	32 [illegible]N 165 6E	PCN 6	T4 0/4 0 /D0 5/24HRS	ULAC 32 0N 165 5E	KGWC
	41	162219	31 9N 165 3E	PCN 6	T[illegible] 4 0 /W0 5/24HRS		KGWC
	42	170000	32 1N 165 4E	PCN 6	T[illegible] 3 0 /W1 0/24HRS	ULCC FIX	PGTW
	43	170506	32 4N 166 0E	PCN 6			KGWC
	44	170600	32 [illegible]N 166 3E	PCN 6		ULCC FIX	PGTW
	45	170708	32 6N 165 9E	PCN 6			KGWC
	46	171057	33 4N 166 8E	PCN 6			KGWC
	47	171200	33 5N 167 3E	PCN 6	T2 0/2 5 /W1 0/24HRS		PGTW
	48	[illegible]	34 2N 168 1E	PCN 4		EXP LLCC ULAC 35 3N 168 0E	KGWC
	49	171800	34 5N 168 0E	PCN 6			PGTW
*	50	[illegible]	35 0N 169 2E	PCN 4		EXP LLCC ULAC 35 3N 170 0E	KGWC
	51	[illegible]	[illegible] 4N 168 3E	PCN 4	T2 0/3 5 /W1 5/24HRS	EXP LLCC	KGWC
	52	180000	35 9N 169 [illegible]E	PCN 6	T2 5/2 5	INIT OBS	PGTW
	53	180600	37 2N 171 1E	PCN 6			PGTW
	54	180858	37 6N 171 9E	PCN 6			KGWC
	55	181039	38 0N 172 5E	PCN 4		ULAC 38 2N 172 7E	KGWC
	56	182138	39 4N 178 2E	PCN 6	T0 5/1 5 /W1 5/24HRS	ULAC 40 5N 172 9F	KGWC
	57	190000	40 4N 179 0E	PCN [illegible]			PGTW

AIRCRAFT FIXES

FIX NO	TIME (Z)	FIX POSITION	FLT LVL	700MB HGT	OBS MSLP	MAX-SFC-WND VEL/BRG RNG	MAX-FLT-LVL-WND DIR/VEL BRG/RNG	ACCRY NAV/MET	EYE SHAPE	EYE ORIEN-DIAM/TATION	EYE TEMP (C) OUT/ IN/ DP/SST	MSN NO
1	141921	24 2N 172 0E	700MB	2981	989	45 100 14	270 26 190 35	10 5			+12 +14 +10	2
2	150531	26 2N 171 5E	1500FT		978	60 030 14	120 55 030 10	10 2			+26 +26 +19 28	4
3	150804	26 8N 171 3E	700MB	2905	977		070 39 320 50	12 5			+14 +16 + 8	4
4	151813	29 2N 170 0E	700MB	2835	970	70 030 60	140 22 030 60	10 4	CIRCULAR	40	+12 +14 +14	5
5	152107	29 5N 169 4E	700MB	2806	970	70 270 10	220 44 230 90	10 3	CIRCULAR	25	+13 +17 +13	5
6	160514	30 9N 167 4E	700MB	2811		60 040 114	130 66 040 65	10 10			+15 +15 +11	[illegible]
7	160808	31 1N 167 0E	700MB	2813	969		060 60 320 126	10 10			+13 +15 +12	[illegible]
8	161801	31 7N 165 6E	700MB	2784		35 050 120	140 60 040 90	10 5	CIRCULAR	10	+13 +14 +14	8
9	162017	31 8N 165 4E	700MB	2793	986	40 320 90	030 60 320 60	10 5	CIRCULAR	15	+11 +14 +14 23	8
10	170540	32 8N 166 0E	700MB	2817		45 190 103	280 49 190 103	10 3			+12 +13 +12	9
11	170827	[illegible] 166 3E	700MB	2828	972		320 47 230 120	10 3			+11 +13 +12	9

NOTICE - THE ASTERISKS (*) INDICATE FIXES UNREPRESENTATIVE AND NOT USED FOR BEST TRACK PURPOSES

TROPICAL STORM LYNN
BEST TRACK DATA

	BEST TRACK		WARNING		ERRORS		24 HOUR FORECAST		ERRORS		48 HOUR FORECAST		ERRORS		72 HOUR FORECAST		ERRORS	
MO/DA/HR	POSIT	WIND	POSIT	WIND	DST	WIND	POSIT	WIND	DST	WIND	POSIT	WIND	DST	WIND	POSIT	WIND	DST	WIND
092400Z	18 6 115 7	25	0 0 0 0	0	0	0	0 0 0 0	0	-0	0	0 0 0 0	0	0	0	0 0 0 0	0	-0	0
092406Z	18 5 115 2	30	18 5 115 0	30	11	0	19 5 111 7	50	130	15	21 1 108 3	40	346	15	22 9 105 1	25	486	0
092412Z	18 4 114 6	30	18 7 114 [illegible]	30	19	0	19 4 112 7	50	136	20	20 6 110 4	60	300	35	22 3 108 4	30	397	10
092418Z	18 2 114 1	35	18 8 114 3	30	38	-5	19 4 112 2	40	149	10	20 2 109 8	40	288	15	21 5 107 2	30	324	15
092500Z	18 0 113 5	40	18 3 113 5	45	18	[illegible]	18 [illegible] 111 2	40	138	15	20 1 108 8	30	284	5	0 0 0 0	0	-0	0
092506Z	17 6 112 8	35	17 6 112 9	45	6	0	16 9 110 8	30	66	5	16 5 107 9	25	72	0	0 0 0 0	0	-0	0
092512Z	17 2 112 1	30	17 2 112 3	40	11	0	16 2 109 4	25	68	0	15 8 106 4	20	93	0	0 0 0 0	0	-0	0
092518Z	17 0 111 5	30	16 9 111 7	30	13	0	16 0 108 3	25	99	0	0 0 0 0	0	0	0	0 0 0 0	0	-0	0
092600Z	16 4 111 0	25	16 6 110 9	25	13	0	15 9 107 4	20	119	-5	0 0 0 0	0	-0	0	0 0 0 0	0	-0	0
092606Z	15 8 110 7	25	16 0 110 0	25	42	0	15 3 107 0	20	93	-5	0 0 0 0	0	-0	0	0 0 0 0	0	-0	0
092612Z	15 6 110 4	25	16 0 110 0	25	33	0	16 0 110 0	20	117	0	0 0 0 0	0	-0	0	0 0 0 0	0	-0	0
092618Z	15 4 109 9	25	16 0 110 0	25	36	0	0 0 0 0	0	-0	0	0 0 0 0	0	-0	0	0 0 0 0	0	-0	0
092700Z	15 4 109 4	25	14 7 109 4	25	42	0	0 0 0 0	0	-0	0	0 0 0 0	0	-0	0	0 0 0 0	0	-0	0
092706Z	15 5 108 6	25	15 0 109 0	25	38	0	0 0 0 0	0	-0	0	0 0 0 0	0	-0	0	0 0 0 0	0	-0	0
092712Z	15 7 108 0	20	15 1 108 4	20	43	0	0 0 0 0	0	0	0	0 0 0 0	0	-0	0	0 0 0 0	0	-0	0
092718Z	16 1 107 4	15	0 0 0 0	0	0	0	0 0 0 0	0	-0	0	0 0 0 0	0	-0	0	0 0 0 0	0	-0	0

	ALL FORECASTS				TYPHOONS WHILE OVER 35 KTS			
	WRNG	24-HR	48-HR	72-HR	WRNG	24-HR	48-HR	72-HR
AVG FORECAST POSIT ERROR	26	112	231	402	0	0	0	0
AVG RIGHT ANGLE ERROR	21	63	178	362	0	0	0	0
AVG INTENSITY MAGNITUDE ERROR	1	8	12	8	0	0	0	0
AVG INTENSITY BIAS	1	6	12	8	0	0	0	0
NUMBER OF FORECASTS	14	10	6	3	0	0	0	0

DISTANCE TRAVELED BY TROPICAL CYCLONE IS 553 NM

AVERAGE SPEED OF TROPICAL CYCLONE IS 6 KNOTS

TROPICAL STORM LYNN
FIX POSITIONS FOR CYCLONE NO. 16

SATELLITE FIXES

FIX NO	TIME (Z)	FIX POSITION	ACCRY	DVORAK CODE	COMMENTS	SITE
* 1	161131	15 1N 111 2E	PCN 5			RPMK
2	230600	18 8N 113 5E	PCN 6	T1 5/1 5	INIT OBS	PGTW
3	231005	19 2N 113 9E	PCN 6			PGTW
4	231800	19 4N 11[illegible] 3E	PCN 6	T1 5/1 5	INIT OBS ULCC FIX	PGTW
5	232245	20 0N 11[illegible] 9E	PCN 5	T1 5/1 5	INIT OBS	RPMK
6	232341	20 1N 11[illegible] 0E	PCN 5			RPMK
7	240000	1[illegible] 1N 11[illegible] 4E	PCN 4			PGTW
8	240[illegible]	[illegible]	PCN 5	T[illegible] 0 2 0	INIT OBS	RODN
9	240600	[illegible]	PCN 6	T[illegible] 5/2 5 /D1 0/24HRS		PGTW
10	241[illegible]	[illegible] 114 [illegible]	PCN 5			PGTW
* 11	241[illegible]	[illegible] 1E	PCN 5			RODN
12	241200	[illegible] 114 [illegible]	PCN 6			PGTW
13	2415[illegible]	[illegible]	PCN 5		ULCC FIX	RPMK
14	24[illegible]	[illegible]	PCN [illegible]	T2 0/2 0 /D0 5/25HRS		RPMK
15	24[illegible]	[illegible]	PCN [illegible]	T2 [illegible] 2 5 /S0 0/19HRS		PGTW
* 16	24[illegible]	[illegible] 114 [illegible]	PCN 5	T[illegible] 0	INIT OBS	RSKO
17	250[illegible]	[illegible]	PCN [illegible]			RPMK
18	250600	1[illegible] 4N 11[illegible]	PCN 4			PGTW
19	250[illegible]	1[illegible] 4N 11[illegible]	PCN 5	T0 5/1 5 /W1 5/24HRS		RODN
20	2511[illegible]	[illegible]	PCN 3			RPMK
21	252116	16 [illegible]N 111 5E	PCN 5			RPMK
22	25[illegible]	16 [illegible]N 110 [illegible]	PCN 4	T1 5/2 5 /W1 0/23HRS		PGTW
23	25[illegible]	1[illegible] 0N 111 1E	PCN 5	T2 5/3 0 /W0 5/23HRS		RSKO
24	2600[illegible]4	1[illegible] 111 4E	PCN 5			RODN
25	2602[illegible]	1[illegible] 111 0E	PCN 3	T1 0/1 5 /W1 0/24HRS		RPMK
26	260203	1[illegible] 110 2E	PCN 5			PGTW
27	260600	1[illegible] 110 2E	PCN 6			PGTW
* 28	260819	1[illegible] 111 0E	PCN 5	T0 5/0 5 /S0 0/24HRS		RODN
29	261131	1[illegible] 110 6E	PCN [illegible]			RODN
* 30	261200	1[illegible] 111 5E	PCN [illegible]	T2 [illegible] 2 5 /D1 0/14HRS		PGTW
* 31	261444	1[illegible] 111 [illegible]E	PCN 5			RODN
* 32	261800	1[illegible] 0N 110 9E	PCN 6			PGTW
* 33	262104	1[illegible] 109 9E	PCN 5		ULCC FIX	RPMK
* 34	2700[illegible]	14 [illegible] 1[illegible] 8E	PCN 5			RODN
35	270010	14 [illegible] 10[illegible] 7E	PCN 5	T1 0/1 5 /S0 0/22HRS		RPMK
* 36	270324	1[illegible] 110 6E	PCN 3			RPMK
37	270600	1[illegible] 10[illegible] 8E	PCN 6	T1 0/1 0-	INIT OBS	PGTW
38	271[illegible]	1[illegible] 10[illegible] 4E	PCN 6			PGTW
39	271[illegible]	1[illegible] 1[illegible] 8E	PCN 6			RPMK
40	271[illegible]	16 [illegible] 10[illegible] 6E	PCN 6			PGTW
41	271[illegible]	1[illegible] 4N 10[illegible] 2E	PCN [illegible]			PGTW

SYNOPTIC FIXES

FIX NO	TIME (Z)	FIX POSITION	INTENSITY ESTIMATE	NEAREST DATA (NM)	COMMENTS
* 1	251200	16 4N 113 0E	020	040	BASED ON 59985 AND 59981 AND SHIP
2	251800	16 [illegible]N 111 9E	020	020	BASED ON 59985 AND 59981

NOTICE - THE ASTERISKS (*) INDICATE FIXES UNREPRESENTATIVE AND NOT USED FOR BEST TRACK PURPOSES

AD-A153 395 1984 ANNUAL TROPICAL CYCLONE REPORT(U) NAVAL OCEANOGRAPHY COMMAND CENTER/JOINT TYPHOON WARNING CENTER FPO SAN FRANCISCO 96630 K G HINMAN ET AL. 1984

3/3

UNCLASSIFIED F/G 4/2 NL

END

FILMED

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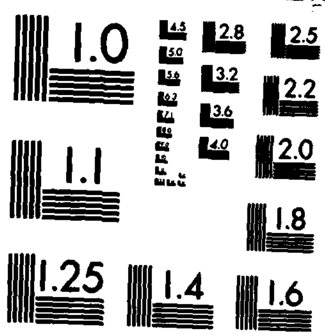

MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A

TROPICAL STORM MAURY BEST TRACK DATA

	BEST TRACK			WARNING					24 HOUR FORECAST					48 HOUR FORECAST					72 HOUR FORECAST				
							ERRORS					ERRORS					ERRORS					ERRORS	
MO/DA/HR	POSIT		WIND	POSIT		WIND	DST	WIND	POSIT		WIND	DST	WIND	POSIT		WIND	DST	WIND	POSIT		WIND	DST	WIND
092712Z	24.6	152.3	25	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
092718Z	24.4	152.2	35	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
092800Z	24.3	152.0	45	23.8	151.9	50.	30.	5.	27.3	154.5	60.	869.	5.	30.6	157.2	70.	432.	10.	33.6	160.2	60.	447.	20.
092806Z	24.2	151.8	50	23.9	152.1	50.	24.	0.	25.8	152.6	60.	146.	0.	28.8	153.3	70.	234.	15.	0.0	0.0	0.	-0.	0.
092812Z	24.1	151.6	50	23.8	152.1	50.	33.	0.	24.2	152.1	60.	140.	0.	26.1	152.7	55.	465.	5.	0.0	0.0	0.	-0.	0.
092818Z	24.1	151.3	55	23.8	152.1	50.	47.	-5.	24.9	151.7	60.	149.	0.	27.7	151.8	60.	440.	15.	0.0	0.0	0.	-0.	0.
092900Z	24.3	150.8	55	24.2	150.7	50.	8.	-5.	25.6	147.0	50.	202.	-10.	29.0	144.8	45.	543.	5.	0.0	0.0	0.	-0.	0.
092906Z	24.7	150.2	60	25.0	150.3	50.	19.	-10.	27.8	149.6	45.	157.	-10.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
092912Z	25.4	149.9	60	25.3	149.9	55.	6.	-5.	27.7	149.0	45.	318.	-5.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
092918Z	26.6	149.7	60	26.6	149.8	50.	5.	-10.	29.7	149.7	45.	313.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
093000Z	28.2	149.4	60	27.9	149.6	55.	21.	-5.	32.2	152.9	45.	237.	5.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
093006Z	30.4	149.2	55	29.4	149.8	50.	68.	-5.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
093012Z	33.0	149.1	50	32.5	149.5	50.	36.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
093018Z	34.9	150.2	45	35.2	150.1	45.	19.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
100100Z	36.0	151.6	40	35.5	150.7	45.	53.	5.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.

	ALL FORECASTS				TYPHOONS WHILE OVER 35 KTS			
	WRNG	24-HR	48-HR	72-HR	WRNG	24-HR	48-HR	72-HR
AVG FORECAST POSIT ERROR	28.	215.	421.	447.	0.	0.	0.	0.
AVG RIGHT ANGLE ERROR	18.	87.	221.	0.	0.	0.	0.	0.
AVG INTENSITY MAGNITUDE ERROR	4.	4.	10.	20.	0.	0.	0.	0.
AVG INTENSITY BIAS	-3.	-2.	10.	20.	0.	0.	0.	0.
NUMBER OF FORECASTS	13	9	5	1	0	0	0	0

DISTANCE TRAVELED BY TROPICAL CYCLONE IS 863. NM

AVERAGE SPEED OF TROPICAL CYCLONE IS 10. KNOTS

TROPICAL STORM MAURY
FIX POSITIONS FOR CYCLONE NO. 17

SATELLITE FIXES

FIX NO.	TIME (Z)	FIX POSITION	ACCRY	DVORAK CODE	COMMENTS	SITE
* 1	271800	22.7N 151.5E	PCN 6	T1.5/1.5	INIT OBS	PGTW
2	271939	24.1N 151.9E	PCN 4			PGTW
3	272204	24.3N 152.2E	PCN 4			PGTW
4	272341	24.8N 152.0E	PCN 4	T2.5/2.5	INIT OBS	PGTW
5	280000	24.5N 152.1E	PCN 6			PGTW
6	280430	24.0N 152.0E	PCN 6			PGTW
7	280600	23.8N 152.5E	PCN 6		ULCC FIX	PGTW
* 8	280819	22.7N 152.8E	PCN 6			PGTW
9	281221	23.8N 151.9E	PCN 5			PGTW
10	281800	24.0N 151.5E	PCN 6	T2.5/2.5 /D1.0/26HRS		PGTW
11	282140	23.9N 151.2E	PCN 5			PGTW
12	282321	24.0N 150.9E	PCN 5			PGTW
13	290300	24.8N 150.4E	PCN 4	T1.5/2.5 /W1.0/28HRS	EXP LLCC	PGTW
14	290600	24.9N 150.5E	PCN 6			PGTW
15	291201	25.3N 149.8E	PCN 2			PGTW
16	291600	26.3N 149.6E	PCN 6			PGTW
17	291844	26.7N 149.9E	PCN 5	T3.0/3.0-/D0.5/25HRS		PGTW
18	292116	27.3N 150.0E	PCN 6			PGTW
19	292301	27.3N 149.4E	PCN 3		EXP LLCC	PGTW
20	300042	28.3N 149.6E	PCN 3		EXP LLCC	PGTW
21	300300	29.0N 149.7E	PCN 6			PGTW
22	301322	32.9N 150.0E	PCN 6			PGTW
23	301831	34.9N 151.2E	PCN 6			PGTW

AIRCRAFT FIXES

FIX NO.	TIME (Z)	FIX POSITION	FLT LVL	700MB HGT	OBS MSLP	MAX-SFC-WND VEL/BRG/RNG	MAX-FLT-LVL-WND DIR/VEL/BRG/RNG	ACCRY NAV/MET	EYE SHAPE	EYE ORIEN- DIAM/TATION	EYE TEMP (C) OUT/ IN/ DP/SST	MSN NO.
1	280303	24.0N 151.8E	700MB	3027	992	50 060 30	130 55 060 30	10 5			+14 +11	1
2	282049	24.0N 151.1E	1500FT		994	55 020 40	130 64 020 40	6 5				2
3	282330	24.2N 150.7E	1500FT		995	55 140 65	230 44 130 35	2 3			+24 +25 +25 25	2
4	290540	24.8N 150.6E	1500FT		995	65 040 35	120 64 040 25	8 15				3
5	290823	24.8N 150.3E	700MB	3058		45 050 35	120 64 060 36	8 8			+13 +13 + 8	3
6	292105	27.3N 149.7E	1500FT		997	70 020 37	130 77 020 37	4 5			+26 +28 +25	4
7	292337	28.0N 149.6E	1500FT		998	45 230 15	260 53 230 13	4 5			+26 +28 +24 31	4
8	301011	32.3N 149.0E	700MB	3065	996		230 45 120 45	12 5				5
9	301143	33.1N 149.1E	700MB	3055			210 59 130 70	12 5			+14 +17 +10	5
10	302038	35.2N 150.6E	700MB	2986		60 080 25	200 45 080 90	10 5				6
11	302212	35.3N 150.9E	700MB	2986		45 050 10	200 45 090 78	5 6			+ 9 +13	6
12	010537	33.9N 152.7E	1500FT		994	70 130 60	220 77 130 46	5 2			+24 +26 +22 30	7
13	010819	34.3N 153.9E	700MB	3012	996		360 42 300 90	13 7			+12 +14 + 9	7

NOTICE - THE ASTERISKS (*) INDICATE FIXES UNREPRESENTATIVE AND NOT USED FOR BEST TRACK PURPOSES.

TROPICAL STORM NINA
BEST TRACK DATA

	BEST TRACK			WARNING			ERRORS		24 HOUR FORECAST			ERRORS		48 HOUR FORECAST			ERRORS		72 HOUR FORECAST			ERRORS	
MO/DA/HR	POSIT		WIND	POSIT		WIND	DST	WIND	POSIT		WIND	DST	WIND	POSIT		WIND	DST	WIND	POSIT		WIND	DST	WIND
092712Z	22.3	141.3	25	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
092718Z	23.2	141.1	30	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
092800Z	23.8	140.9	35	24.5	141.4	40.	50.	5.	27.0	141.3	60.	98.	15.	29.7	142.2	70.	130.	40.	32.7	145.2	65.	233.	10.
092806Z	24.2	140.8	40	25.2	141.0	45.	61.	5.	28.0	140.9	60.	120.	20.	31.1	142.0	70.	161.	40.	34.0	145.3	65.	373.	10.
092812Z	24.6	140.7	45	24.4	140.6	50.	13.	5.	25.6	140.5	60.	56.	20.	27.6	140.5	70.	242.	35.	29.5	140.8	70.	840.	20.
092818Z	25.0	140.7	45	24.8	140.6	50.	13.	5.	25.9	140.6	60.	69.	25	27.9	140.6	70.	385.	25.	0.0	0.0	0.	-0.	0.
092900Z	25.5	140.6	45	25.5	140.6	45.	0.	0.	27.6	140.8	30.	43.	0.	29.6	141.2	25.	475.	-30.	0.0	0.0	0.	-0.	0.
092906Z	26.0	140.7	40	26.1	140.7	45.	6.	5.	28.3	140.9	30.	101.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
092912Z	26.5	140.8	40	26.5	140.6	45.	11.	5.	28.4	141.0	30.	197.	-5.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
092918Z	27.0	141.0	35	27.0	140.7	40.	16.	5.	29.0	141.0	30.	336.	-15.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
093000Z	27.6	141.6	30	27.3	141.5	30.	19.	0.	28.5	144.0	20.	384.	-35.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
093006Z	28.5	142.8	30	27.9	142.5	30.	39.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
093012Z	29.6	144.5	35	28.9	143.0	30.	89.	-5.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
093018Z	31.1	147.0	45	30.4	145.5	30.	88.	-15.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
100100Z	32.5	149.8	55	32.5	149.8	50.	0.	-5.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
100106Z	33.9	152.8	55	34.2	152.7	50.	19.	-5.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
100112Z	35.1	156.0	50	35.0	155.5	45.	25.	-5.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.

	ALL FORECASTS				TYPHOONS WHILE OVER 35 KTS			
	WRNG	24-HR	48-HR	72-HR	WRNG	24-HR	48-HR	72-HR
AVG FORECAST POSIT ERROR	30.	156.	279.	482.	0.	0.	0.	0.
AVG RIGHT ANGLE ERROR	12.	37.	85.	146.	0.	0.	0.	0.
AVG INTENSITY MAGNITUDE ERROR	5.	15.	34.	13.	0.	0.	0.	0.
AVG INTENSITY BIAS	0.	3.	22.	13.	0.	0.	0.	0.
NUMBER OF FORECASTS	15	9	5	3	0	0	0	0

DISTANCE TRAVELED BY TROPICAL CYCLONE IS 1201. NM

AVERAGE SPEED OF TROPICAL CYCLONE IS 13. KNOTS

TROPICAL STORM NINA
FIX POSITIONS FOR CYCLONE NO. 18

SATELLITE FIXES

	FIX NO.	TIME (Z)	FIX POSITION	ACCRY	DVORAK CODE	COMMENTS	SITE
	1	270840	22.6N 142.1E	PCN 6	T1.0/1.0	INIT OBS	PGTW
	2	271200	22.5N 141.6E	PCN 6			PGTW
	3	271600	22.3N 141.7E	PCN 6	T1.5/1.5	INIT OBS	PGTW
	4	271800	22.4N 141.5E	PCN 6			PGTW
	5	271939	23.8N 141.6E	PCN 6		EXP LLCC TO NW	PGTW
	6	272204	24.1N 141.6E	PCN 6			PGTW
*	7	280000	24.8N 141.9E	PCN 6		ULCC FIX	PGTW
*	8	280300	25.4N 141.9E	PCN 6		ULCC FIX	PGTW
	9	280612	24.2N 140.2E	PCN 4	T2.0/2.0 /D1.0/22HRS		PGTW
	10	282059	25.3N 140.9E	PCN 4		EXP LLCC	PGTW
	11	282140	25.5N 140.8E	PCN 3		EXP LLCC	PGTW
	12	290102	25.8N 140.5E	PCN 3		EXP LLCC	PGTW
	13	290559	26.1N 140.7E	PCN 3	T1.5/2.0 /W0.5/24HRS	EXP LLCC	PGTW
	14	290559	26.0N 140.8E	PCN 5	T1.5/1.5	INIT OBS	RPMK
	15	290939	25.9N 140.2E	PCN 5			PGTW
	16	291200	26.1N 140.3E	PCN 6			PGTW
	17	291343	26.8N 140.4E	PCN 3		EXP LLCC	PGTW
	18	291844	27.1N 141.0E	PCN 5	T2.0/2.0	INIT OBS	PGTW
	19	292038	27.4N 140.7E	PCN 3		EXP LLCC	PGTW
	20	300042	26.9N 141.5E	PCN 5		EXP LLCC	PGTW
	21	300300	27.5N 142.0E	PCN 4		EXP LLCC	PGTW
	22	300600	28.5N 142.9E	PCN 6	T1.0/1.5 /W0.5/24HRS		PGTW
	23	301322	29.8N 145.0E	PCN 6			PGTW
	24	301800	30.4N 146.6E	PCN 6	T2.0/2.0-/S0.0/24HRS		PGTW
	25	302233	31.9N 148.6E	PCN 6			PGTW
	26	010022	32.4N 149.7E	PCN 5			PGTW
	27	010534	33.7N 152.4E	PCN 5	T2.5/2.5-/D1.5/24HRS		PGTW
	28	010856	34.2N 154.4E	PCN 6			PGTW
	29	011200	34.7N 155.4E	PCN 6			PGTW
	30	011600	35.6N 158.2E	PCN 6			PGTW
	31	011800	36.3N 159.3E	PCN 6	T3.5/3.5-/D1.5/24HRS		PGTW
	32	012100	36.5N 161.5E	PCN 5			PGTW
	33	020000	35.8N 163.4E	PCN 4			PGTW
	34	020300	36.0N 164.9E	PCN 6			PGTW

AIRCRAFT FIXES

FIX NO.	TIME (Z)	FIX POSITION	FLT LVL	700MB HGT	OBS MSLP	MAX-SFC-WND VEL/BRG/RNG	MAX-FLT-LVL-WND DIR/VEL/BRG/RNG	ACCRY NAV/MET	EYE SHAPE	EYE DIAM	ORIEN-TATION	EYE TEMP (C) OUT/ IN/ DP/SST	MSN NO.
1	292249	27.5N 141.5E	1500FT		994	25 330 40	030 38 330 40	5 15				+26 +26 +24 29	4
2	302341	32.6N 149.8E	700MB	2982		75 230 20	350 25 320 50	8 7	CIRCULAR	10		+ 7 +11	6

RADAR FIXES

	FIX NO.	TIME (Z)	FIX POSITION	RADAR	ACCRY	EYE SHAPE	EYE DIAM	RADOB-CODE ASWAR TDDFF	COMMENTS	RADAR POSITION	SITE WMO NO.
	1	281200	24.6N 141.0E	0				50022 RJAW	WMO 47981		
*	2	301926	32.1N 147.2E	ACFT							

NOTICE - THE ASTERISKS (*) INDICATE FIXES UNREPRESENTATIVE AND NOT USED FOR BEST TRACK PURPOSES.

TYPHOON OGDEN
BEST TRACK DATA

BEST TRACK			WARNING				24 HOUR FORECAST				48 HOUR FORECAST				72 HOUR FORECAST			
					ERRORS				ERRORS				ERRORS				ERRORS	
MO/DA/HR	POSIT	WIND	POSIT	WIND	DST	WIND	POSIT	WIND	DST	WIND	POSIT	WIND	DST	WIND	POSIT	WIND	DST	WIND
100700Z	18.1 152.3	25	18.5 152.4	25.	25.	0.	21.8 151.2	35.	183.	-10.	26.6 150.9	50.	417.	-20.	0.0 0.0	0.	-0.	0.
100706Z	19.1 152.1	30	19.0 152.0	30.	8.	0.	22.1 151.1	40.	276.	-10.	26.5 150.9	50.	560.	-15.	0.0 0.0	0.	-0.	0.
100712Z	20.4 152.2	30	19.6 151.6	30.	59.	0.	22.8 150.6	40.	347.	-15.	27.2 150.7	50.	702.	-15.	0.0 0.0	0.	-0.	0.
100718Z	21.9 152.7	35	20.4 151.6	35.	109.	0.	23.6 151.0	45.	394.	-15.	28.0 151.5	55.	802.	-5.	0.0 0.0	0.	-0.	0.
100800Z	23.8 153.7	45	24.0 153.3	40.	25.	-5.	32.5 160.9	45.	235.	-25.	0.0 0.0	0.	-0.	0.	0.0 0.0	0.	-0.	0.
100806Z	25.4 154.6	50	25.8 155.0	50.	32.	0.	35.4 162.8	50.	298.	-15.	0.0 0.0	0.	-0.	0.	0.0 0.0	0.	-0.	0.
100812Z	26.5 155.5	55	26.6 155.6	50.	8.	-5.	31.8 158.9	50.	201.	-15.	0.0 0.0	0.	-0.	0.	0.0 0.0	0.	-0.	0.
100818Z	27.8 156.6	60	27.6 156.4	50.	16.	-10.	32.5 160.2	50.	279.	-10.	0.0 0.0	0.	-0.	0.	0.0 0.0	0.	-0.	0.
100900Z	29.4 158.1	70	29.1 157.7	70.	28.	0.	0.0 0.0	0.	-0.	0.	0.0 0.0	0.	-0.	0.	0.0 0.0	0.	-0.	0.
100906Z	30.9 160.3	65	30.7 159.8	65.	28.	0.	0.0 0.0	0.	-0.	0.	0.0 0.0	0.	-0.	0.	0.0 0.0	0.	-0.	0.
100912Z	32.4 162.8	65	32.2 162.8	65.	12.	0.	0.0 0.0	0.	-0.	0.	0.0 0.0	0.	-0.	0.	0.0 0.0	0.	-0.	0.
100918Z	33.9 165.5	60	33.9 165.8	60.	15.	0.	0.0 0.0	0.	-0.	0.	0.0 0.0	0.	-0.	0.	0.0 0.0	0.	-0.	0.

	ALL FORECASTS				TYPHOONS WHILE OVER 35 KTS			
	WRNG	24-HR	48-HR	72-HR	WRNG	24-HR	48-HR	72-HR
AVG FORECAST POSIT ERROR	30.	277.	620.	0.	30.	277.	620.	0.
AVG RIGHT ANGLE ERROR	15.	100.	219.	0.	15.	100.	219.	0.
AVG INTENSITY MAGNITUDE ERROR	2.	14.	14.	0.	2.	14.	14.	0.
AVG INTENSITY BIAS	-2.	-14.	-14.	0.	-2.	-14.	-14.	0.
NUMBER OF FORECASTS	12	8	4	0	9	8	4	0

DISTANCE TRAVELED BY TROPICAL CYCLONE IS 1236. NM

AVERAGE SPEED OF TROPICAL CYCLONE IS 19. KNOTS

TYPHOON OGDEN
FIX POSITIONS FOR CYCLONE NO. 19

SATELLITE FIXES

FIX NO.	TIME (Z)	FIX POSITION	ACCRY	DVORAK CODE	COMMENTS	SITE
* 1	051800	12.4N 151.2E	PCN 6	T0.0/0.0	INIT OBS	PGTW
* 2	060000	13.5N 152.5E	PCN 6			PGTW
* 3	060300	17.9N 154.4E	PCN 6	T1.0/1.0	INIT OBS	PGTW
* 4	060600	18.1N 155.1E	PCN 6		ULCC FIX	PGTW
* 5	060900	18.5N 155.0E	PCN 6		ULCC FIX	PGTW
* 6	061200	18.7N 155.1E	PCN 6			PGTW
* 7	061600	18.5N 155.0E	PCN 6	T1.5/1.5 /D1.5/22HRS		PGTW
* 8	061800	18.6N 154.8E	PCN 6			PGTW
* 9	061950	18.6N 155.0E	PCN 6			PGTW
* 10	062100	18.4N 154.8E	PCN 6			PGTW
11	070002	18.4N 152.9E	PCN 5			PGTW
12	070300	19.0N 151.6E	PCN 4	T1.0/1.0 /S0.0/24HRS	EXP LLCC	PGTW
13	070601	18.9N 152.3E	PCN 3			PGTW
14	070830	19.0N 151.6E	PCN 6			PGTW
* 15	071242	19.9N 153.5E	PCN 6			PGTW
* 16	071600	20.2N 153.6E	PCN 6	T2.0/2.0 /D0.5/24HRS		PGTW
* 17	071800	20.8N 154.1E	PCN 6			PGTW
* 18	072124	21.9N 152.8E	PCN 6		ULCC 23.0N 155.5E	PGTW
19	072342	24.5N 153.3E	PCN 4	T2.5/2.5-/D1.5/21HRS		PGTW
20	072342	24.2N 153.8E	PCN 3	T3.5/3.5	INIT OBS	RODN
* 21	080300	25.6N 154.6E	PCN 4	T3.5/3.5 /D2.5/24HRS		PGTW
22	080542	25.7N 154.8E	PCN 3			PGTW
23	080542	25.3N 154.8E	PCN 3			RODN
24	080821	26.0N 155.1E	PCN 4			PGTW
25	081222	26.6N 155.6E	PCN 3			PGTW
* 26	081222	26.9N 154.5E	PCN 4			RODN
27	081600	27.2N 156.1E	PCN 6	T3.0/3.0-/D1.0/24HRS		PGTW
28	081833	27.6N 156.5E	PCN 5			PGTW
29	082100	28.4N 157.3E	PCN 6			PGTW
30	082321	29.2N 158.1E	PCN 3			PGTW
31	090300	29.8N 159.2E	PCN 4	T4.0/4.0-/D0.5/24HRS		PGTW
32	090536	30.5N 160.7E	PCN 4			PGTW
33	090900	31.4N 161.6E	PCN 6			PGTW
34	091200	32.2N 162.7E	PCN 6		ULCC FIX	PGTW
35	091600	33.5N 164.8E	PCN 6	T4.5/4.5 /D1.5/24HRS		PGTW
36	091638	33.1N 165.1E	PCN 6			KGWC
37	091800	34.0N 165.7E	PCN 6		ULCC FIX	PGTW
38	091820	34.3N 166.0E	PCN 5			RODN
39	091846	34.3N 166.0E	PCN 6		ULAC 34.7N 167.1E	KGWC
40	092301	35.5N 169.5E	PCN 6			KGWC
41	100000	35.8N 169.3E	PCN 6			PGTW
42	100400	37.7N 172.8E	PCN 6	T4.0/4.0-/S0.0/25HRS		PGTW

AIRCRAFT FIXES

FIX NO.	TIME (Z)	FIX POSITION	FLT LVL	700MB HGT	OBS MSLP	MAX-SFC-WND VEL/BRG/RNG	MAX-FLT-LVL-WND DIR/VEL/BRG/RNG	ACCRY NAV/MET	EYE SHAPE	EYE DIAM/ORIENTATION	EYE TEMP (C) OUT/ IN/ DP/SST	MSN NO.
1	062227	18.4N 152.2E	1500FT		999	15 340 70	180 16 030 70	10 3			+26 +26 +25 26	2
2	070533	18.8N 152.2E	1500FT		997	45 130 140	210 38 130 125	10 25			+29 +29 +25 26	3
3	070821	19.9N 152.6E	700MB	3020	1000		180 29 080 54	13 7			+16 +16 + 9	3
* 4	072046	22.1N 152.2E	1500FT		998	25 040 105	340 30 220 82	45 15			+29 +29 +28 27	5
5	072359	23.8N 154.0E	1500FT		993	45 100 25	240 24 180 45	15 5			+29 +30 +23 28	5
6	080540	25.5N 154.7E	700MB	2976		50 150 15	220 58 130 60	12 15			+12 +13 +13	6
7	080817	25.8N 155.0E	700MB	2961	986	40 040 60	130 51 040 90	10 10			+13 +13 +11	6
8	082132	29.0N 157.6E	700MB	2945	983	70 250 30	310 76 250 88	5 1			+12 +15 +14	7
9	082312	29.3N 158.0E	700MB	2942	982	40 280 90	170 68 060 70	5 5	CIRCULAR	40	+13 +14 +14	7

NOTICE - THE ASTERISKS (*) INDICATE FIXES UNREPRESENTATIVE AND NOT USED FOR BEST TRACK PURPOSES.

TYPHOON PHYLLIS
BEST TRACK DATA

	BEST TRACK			WARNING			ERRORS		24 HOUR FORECAST			ERRORS		48 HOUR FORECAST			ERRORS		72 HOUR FORECAST			ERRORS	
MO/DA/HR	POSIT		WIND	POSIT		WIND	DST	WIND	POSIT		WIND	DST	WIND	POSIT		WIND	DST	WIND	POSIT		WIND	DST	WIND
100912Z	18.4	151.3	20	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
100918Z	18.7	151.6	25	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
101000Z	19.1	151.9	25	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
101006Z	19.2	152.1	25	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
101012Z	19.4	152.2	30	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
101018Z	19.6	152.3	30	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
101100Z	19.7	152.4	35	19.5	152.2	30.	16.	-5.	20.0	151.5	50.	126.	-15.	22.0	150.0	75.	252.	5.	26.0	149.3	75.	498.	40.
101106Z	20.1	152.4	45	19.9	152.3	45.	13.	0.	21.1	151.7	70.	112.	0.	24.0	150.3	80.	231.	15.	0.0	0.0	0.	-0.	0.
101112Z	20.7	152.1	55	20.6	152.1	55.	6.	0.	22.5	151.4	75.	85.	-5.	26.4	151.7	80.	186.	25.	0.0	0.0	0.	-0.	0.
101118Z	21.4	151.7	60	21.4	151.7	55.	0.	-5.	26.0	150.8	75.	77.	-5.	30.3	155.2	65.	196.	20.	0.0	0.0	0.	-0.	0.
101200Z	22.1	151.3	65	22.2	151.3	65.	6.	0.	26.8	151.2	85.	49.	15.	30.3	156.8	70.	299.	35.	0.0	0.0	0.	-0.	0.
101206Z	22.9	151.2	70	22.9	150.9	70.	17.	0.	26.4	150.8	80.	87.	15.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
101212Z	23.9	151.0	80	23.7	150.8	85.	25.	5.	27.3	151.3	75.	132.	20.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
101218Z	24.8	151.3	80	24.7	150.7	90.	33.	10.	29.1	150.7	115.	159.	70.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	[illegible]
101300Z	26.0	151.4	70	25.9	151.2	80.	12.	10.	30.7	151.5	65.	194.	30.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
101306Z	27.7	151.5	65	27.7	151.4	70.	5.	5.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
101312Z	29.5	151.5	55	29.6	151.2	65.	17.	10.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
101318Z	31.6	151.7	45	31.7	151.3	60.	21.	15.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
101400Z	33.8	152.6	35	34.0	152.2	35.	23.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.

	ALL FORECASTS				TYPHOONS WHILE OVER 35 KTS			
	WRNG	24-HR	48-HR	72-HR	WRNG	24-HR	48-HR	72-HR
AVG FORECAST POSIT ERROR	15.	113.	233.	498.	15.	113.	233.	498.
AVG RIGHT ANGLE ERROR	12.	23.	120.	113.	12.	23.	120.	113.
AVG INTENSITY MAGNITUDE ERROR	5.	19.	20.	40.	5.	19.	20.	40.
AVG INTENSITY BIAS	3.	14.	20.	40.	3.	14.	20.	40.
NUMBER OF FORECASTS	13	9	5	1	13	9	5	1

DISTANCE TRAVELED BY TROPICAL CYCLONE IS 972. NM

AVERAGE SPEED OF TROPICAL CYCLONE IS 9. KNOTS

TYPHOON PHYLLIS
FIX POSITIONS FOR CYCLONE NO. 20

SATELLITE FIXES

FIX NO.	TIME (Z)	FIX POSITION	ACCRY	DVORAK CODE	COMMENTS	SITE
1	072124	13.7N 146.9E	PCN 6	T0.0/0.0	INIT OBS	PGTW
2	091202	18.8N 150.7E	PCN 6	T0.5/0.5	INIT OBS	PGTW
* 3	092028	20.2N 152.5E	PCN 6		ULCC FIX	PGTW
4	092301	18.6N 152.1E	PCN 6	T1.5/1.5	INIT OBS	PGTW
5	100400	19.7N 152.3E	PCN 6		ULCC 20.7N 152.3E	PGTW
* 6	100600	20.5N 152.6E	PCN 6			PGTW
* 7	100900	20.3N 152.8E	PCN 6			PGTW
8	101141	20.1N 152.7E	PCN 6			PGTW
9	101600	19.8N 152.4E	PCN 6	T2.0/2.0	INIT OBS	PGTW
10	101800	20.0N 152.3E	PCN 6		ULCC FIX	PGTW
11	102007	19.6N 152.4E	PCN 4			PGTW
12	102152	19.4N 152.0E	PCN 4			PGTW
13	110022	19.5N 152.5E	PCN 5	T2.5/2.5 /D1.0/25HRS		PGTW
14	110511	19.8N 152.3E	PCN 3			PGTW
15	110847	20.3N 152.3E	PCN 4			PGTW
16	111200	20.6N 152.0E	PCN 6			PGTW
17	111303	20.7N 152.1E	PCN 3			PGTW
18	111600	21.2N 151.7E	PCN 4			PGTW
19	111755	21.6N 151.3E	PCN 4	T3.5/3.5 /D1.5/26HRS		PGTW
20	112128	21.8N 151.6E	PCN 3			PGTW
21	120000	22.0N 151.4E	PCN 3	T4.0/4.0 /D1.5/24HRS		PGTW
22	120458	22.6N 151.1E	PCN 3			PGTW
23	120600	22.8N 150.9E	PCN 4			PGTW
24	120825	23.1N 151.1E	PCN 4			PGTW
25	121243	23.9N 151.3E	PCN 4			PGTW
26	121600	24.5N 151.0E	PCN 4			PGTW
27	121743	24.7N 150.8E	PCN 2	T5.0/5.0 /D1.5/24HRS		PGTW
28	121924	25.0N 150.7E	PCN 4			PGTW
29	122104	25.3N 151.2E	PCN 3			PGTW
30	122342	26.1N 151.8E	PCN 4	T3.5/4.0-/W0.5/24HRS		PGTW
31	130400	26.7N 151.4E	PCN 6			PGTW
32	130445	27.2N 151.5E	PCN 6			PGTW
33	130600	27.8N 151.9E	PCN 6		ULCC FIX	PGTW
34	131222	29.7N 151.1E	PCN 4		EXP LLCC	PGTW
35	131222	29.2N 151.9E	PCN 6		ULCC FIX	RODN
* 36	132321	35.5N 154.0E	PCN 5	T2.0/2.0	INIT OBS	RODN
* 37	132322	34.9N 153.5E	PCN 6			PGTW

AIRCRAFT FIXES

FIX NO.	TIME (Z)	FIX POSITION	FLT LVL	700MB HGT	OBS MSLP	MAX-SFC-WND VEL/BRG/RNG	MAX-FLT-LVL-WND DIR/VEL/BRG/RNG	ACCRY NAV/MET	EYE SHAPE	EYE ORIEN- DIAM/TATION	EYE TEMP (C) OUT/ IN/ DP/SST	MSN NO.
1	110401	20.0N 152.4E	1500FT		989	50 240 10	330 50 240 10	8 4	CIRCULAR	10	+30 +30 28	1
2	112042	21.7N 151.6E	700MB	2986	985	65 270 5	160 60 030 20	12 1	CIRCULAR	10	+11 +17 +10	2
3	112322	22.1N 151.3E	700MB	2953	983	95 180 10	240 57 150 20	12 1	CIRCULAR	15	+17 +18 +12	2
4	120855	23.3N 151.2E	700MB	2920	975		260 91 220 20	10 5	CIRCULAR	15	+16 +24 +10	3
5	121128	23.8N 151.1E	700MB	2927	974		320 74 230 12	8 2	CIRCULAR	10	+14 +27 +10	3
6	122032	25.1N 151.3E	700MB	2950		70 110 8	260 65 110 10	10 5	CIRCULAR	30	+15 +24 +12	4
7	122304	25.8N 151.2E	700MB	2973	988	65 050 50	140 55 050 50	10 5	CIRCULAR	30	+16 +24	4
8	130645	28.0N 151.5E	700MB	3056		65 200 60	150 65 040 15	15 10			+17 +23 +10	5
9	130831	28.5N 151.4E	700MB	3085	997		260 50 130 60	15 15			+18 +22 + 7	5
10	132327	33.7N 152.4E	1500FT		999	35 150 30	260 43 180 77	8 4			+26 +26 +18 25	6

NOTICE - THE ASTERISKS (*) INDICATE FIXES UNREPRESENTATIVE AND NOT USED FOR BEST TRACK PURPOSES.

TROPICAL STORM ROY
BEST TRACK DATA

MO/DA/HR	BEST TRACK POSIT		BEST TRACK WIND	WARNING POSIT		WARNING WIND	WARNING ERRORS DST	WARNING ERRORS WIND	24 HOUR FORECAST POSIT		24 HOUR FORECAST WIND	24 HR ERRORS DST	24 HR ERRORS WIND	48 HOUR FORECAST POSIT		48 HOUR FORECAST WIND	48 HR ERRORS DST	48 HR ERRORS WIND	72 HOUR FORECAST POSIT		72 HOUR FORECAST WIND	72 HR ERRORS DST	72 HR ERRORS WIND
100918Z	9.3	140.1	20	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
101000Z	9.8	141.0	20	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
101006Z	10.4	141.8	25	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
101012Z	11.0	142.4	25	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
101018Z	11.8	143.0	25	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
101100Z	12.7	143.2	30	12.7	143.2	30.	0.	0.	16.3	143.0	50.	68.	25.	19.4	141.0	60.	207.	50.	0.0	0.0	0.	-0.	0.
101106Z	13.6	143.2	35	13.8	143.1	35.	13.	0.	17.8	142.0	55.	129.	35.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
101112Z	14.2	143.2	30	14.7	142.8	40.	38.	10.	18.9	141.0	60.	186.	40.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
101118Z	14.8	143.2	25	16.2	142.0	40.	109.	15.	23.9	142.1	45.	326.	30.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
101200Z	15.2	143.3	25	15.2	143.2	30.	6.	5.	17.8	143.2	35.	154.	25.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
101206Z	16.2	143.5	20	16.2	143.5	30.	0.	10.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
101212Z	17.3	143.8	20	17.4	143.7	30.	8.	10.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
101218Z	18.8	144.1	15	18.7	143.9	30.	13.	15.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
101300Z	20.0	144.6	10	20.0	144.5	20.	6.	10.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.

	ALL FORECASTS WRNG	ALL FORECASTS 24-HR	ALL FORECASTS 48-HR	ALL FORECASTS 72-HR	TYPHOONS WHILE OVER 35 KTS WRNG	24-HR	48-HR	72-HR
AVG FORECAST POSIT ERROR	21.	173.	207.	0.	0.	0.	0.	0.
AVG RIGHT ANGLE ERROR	18.	87.	179.	0.	0.	0.	0.	0.
AVG INTENSITY MAGNITUDE ERROR	8.	31.	50.	0.	0.	0.	0.	0.
AVG INTENSITY BIAS	8.	31.	50.	0.	0.	0.	0.	0.
NUMBER OF FORECASTS	9	5	1	0	0	0	0	0

DISTANCE TRAVELED BY TROPICAL CYCLONE IS 735. NM

AVERAGE SPEED OF TROPICAL CYCLONE IS 9. KNOTS

TROPICAL STORM ROY
FIX POSITIONS FOR CYCLONE NO. 21

SATELLITE FIXES

FIX NO.	TIME (Z)	FIX POSITION	ACCRY	DVORAK CODE	COMMENTS	SITE
1	091820	9.7N 140.1E	PCN 6		ULCC FIX	PGTW
2	092028	10.5N 140.7E	PCN 6		ULCC FIX	PGTW
3	100400	10.0N 142.2E	PCN 6	T1.5/1.5	INIT OBS	PGTW
4	100600	10.4N 142.0E	PCN 6			PGTW
5	100908	10.8N 141.3E	PCN 6			PGTW
6	101200	11.5N 141.8E	PCN 6		ULCC FIX	PGTW
7	101322	11.0N 142.8E	PCN 6			PGTW
8	101600	11.3N 143.1E	PCN 6	T1.5/1.5	INIT OBS	PGTW
9	101800	11.5N 143.1E	PCN 6		ULCC FIX	PGTW
10	102007	12.0N 143.4E	PCN 6			PGTW
11	102152	12.1N 143.2E	PCN 3			PGTW
12	110022	12.7N 143.2E	PCN 3			PGTW
13	110400	13.3N 143.2E	PCN 4			PGTW
14	110652	13.8N 143.0E	PCN 5	T2.5/2.5 /D1.0/27HRS		PGTW
15	110847	14.3N 142.9E	PCN 6			PGTW
16	111200	14.6N 142.7E	PCN 6			PGTW
17	111303	14.6N 142.6E	PCN 5			PGTW
* 18	111800	16.8N 141.8E	PCN 6	T1.0/1.5 /W0.5/26HRS		PGTW
19	112128	14.8N 143.0E	PCN 5			PGTW
20	120000	15.2N 143.4E	PCN 3		EXP LLCC	PGTW
21	120400	16.0N 143.6E	PCN 4			PGTW
22	120640	16.1N 143.8E	PCN 3	T2.0/2.5 /W0.5/24HRS		PGTW
23	120825	16.7N 143.7E	PCN 4		EXP LLCC	PGTW
24	121007	17.1N 143.8E	PCN 5			PGTW
25	121243	17.5N 143.6E	PCN 6			PGTW
26	122342	20.0N 144.6E	PCN 4			PGTW

AIRCRAFT FIXES

FIX NO.	TIME (Z)	FIX POSITION	FLT LVL	700MB HGT	OBS MSLP	MAX-SFC-WND VEL/BRG/RNG	MAX-FLT-LVL-WND DIR/VEL/BRG/RNG	ACCRY NAV/MET	EYE SHAPE	EYE DIAM/ORIENTATION	EYE TEMP (C) OUT/ IN/ DP/SST	MSN NO.
1	110046	12.8N 143.3E	1500FT		1000	30 140 20	230 29 140 20	5 10			+30 +31 +21 28	1
2	110536	13.6N 143.1E	1500FT		999	40 110 23	080 44 020 37	9 2			+26 +27 +26	2
3	110829	14.1N 143.1E	1500FT		998	25 240 30	360 22 240 41	8 3			+26 +27 +26	2
4	112327	15.2N 143.3E	1500FT		1000	30 140 20	260 40 140 20	4 2			+31 +31 +28 27	3
5	120531	16.2N 143.5E	1500FT		996	20 160 40	240 28 160 85	7 2			+25 +27 +25	4
6	120824	16.8N 143.6E	1500FT		998	10 200 30	230 23 220 53	8 2			+27 +27 +27	4

NOTICE - THE ASTERISKS (*) INDICATE FIXES UNREPRESENTATIVE AND NOT USED FOR BEST TRACK PURPOSES.

TROPICAL STORM SUSAN
BEST TRACK DATA

	BEST TRACK		WARNING		ERRORS		24 HOUR FORECAST		ERRORS		48 HOUR FORECAST		ERRORS		72 HOUR FORECAST		ERRORS	
MO/DA/HR	POSIT	WIND	POSIT	WIND	DST	WIND	POSIT	WIND	DST	WIND	POSIT	WIND	DST	WIND	POSIT	WIND	DST	WIND
101106Z	11.5 116.2	25	0.0 0.0	0.	-0.	0.	0.0 0.0	0.	-0.	0.	0.0 0.0	0.	-0.	0.	0.0 0.0	0.	-0.	0.
101112Z	11.4 114.6	25	0.0 0.0	0.	-0.	0.	0.0 0.0	0.	-0.	0.	0.0 0.0	0.	-0.	0.	0.0 0.0	0.	-0.	0.
101118Z	11.9 113.0	30	12.0 112.5	30.	30.	0.	13.0 108.3	30.	47.	5.	0.0 0.0	0.	-0.	0.	0.0 0.0	0.	-0.	0.
101200Z	12.1 111.6	35	12.2 111.5	35.	8.	0.	0.0 0.0	0.	-0.	0.	0.0 0.0	0.	-0.	0.	0.0 0.0	0.	-0.	0.
101206Z	12.5 110.1	40	12.5 110.1	40.	0.	0.	0.0 0.0	0.	-0.	0.	0.0 0.0	0.	-0.	0.	0.0 0.0	0.	-0.	0.
101212Z	12.5 108.6	30	12.3 108.5	30.	13.	0.	0.0 0.0	0.	-0.	0.	0.0 0.0	0.	-0.	0.	0.0 0.0	0.	-0.	0.
101218Z	13.0 107.5	25	12.9 107.3	25.	13.	0.	0.0 0.0	0.	-0.	0.	0.0 0.0	0.	-0.	0.	0.0 0.0	0.	-0.	0.
101300Z	13.6 106.9	20	0.0 0.0	0.	-0.	0.	0.0 0.0	0.	-0.	0.	0.0 0.0	0.	-0.	0.	0.0 0.0	0.	-0.	0.

	ALL FORECASTS				TYPHOONS WHILE OVER 35 KTS			
	WRNG	24-HR	48-HR	72-HR	WRNG	24-HR	48-HR	72-HR
AVG FORECAST POSIT ERROR	13.	47.	0.	0.	0.	0.	0.	0.
AVG RIGHT ANGLE ERROR	9.	25.	0.	0.	0.	0.	0.	0.
AVG INTENSITY MAGNITUDE ERROR	0.	5.	0.	0.	0.	0.	0.	0.
AVG INTENSITY BIAS	0.	5.	0.	0.	0.	0.	0.	0.
NUMBER OF FORECASTS	5	1	0	0	0	0	0	0

DISTANCE TRAVELED BY TROPICAL CYCLONE IS 576. NM

AVERAGE SPEED OF TROPICAL CYCLONE IS 14. KNOTS

TROPICAL STORM SUSAN
FIX POSITIONS FOR CYCLONE NO. 22

SATELLITE FIXES

	FIX NO.	TIME (Z)	FIX POSITION	ACCRY	DVORAK CODE	COMMENTS	SITE
	1	100600	11.2N 116.1E	PCN 4	T1.5/1.5	INIT OBS	PGTW
*	2	101200	12.8N 112.7E	PCN 6			PGTW
*	3	101600	13.7N 112.5E	PCN 6			PGTW
*	4	101800	13.6N 112.6E	PCN 6	T1.0/1.0	INTI OBS ULCC FIX	PGTW
	5	110400	11.4N 116.8E	PCN 6	T1.5/1.5+/S0.0/22HRS		PGTW
	6	110600	11.4N 116.5E	PCN 6			PGTW
	7	110834	11.5N 116.6E	PCN 5	T1.5/1.5	INIT OBS	RPMK
	8	111028	11.0N 115.4E	PCN 5			PGTW
	9	111200	11.0N 115.0E	PCN 6			PGTW
	10	111444	11.6N 113.7E	PCN 5			RPMK
	11	111600	12.2N 112.6E	PCN 6	T2.5/2.5 /D1.5/22HRS		PGTW
*	12	111800	11.8N 111.2E	PCN 6			PGTW
	13	112100	11.8N 112.2E	PCN 6			PGTW
	14	112309	12.3N 112.1E	PCN 5			PGTW
	15	112309	12.3N 111.7E	PCN 5			RPMK
	16	120000	12.2N 111.4E	PCN 6			PGTW
	17	120400	12.5N 110.7E	PCN 6	T3.0/3.0-/D1.5/24HRS		PGTW
	18	120600	12.8N 110.1E	PCN 6			PGTW
	19	120822	12.3N 109.2E	PCN 5	T2.0/2.0-/D0.5/24HRS		RPMK
	20	120900	12.5N 109.2E	PCN 6			PGTW
	21	121147	12.6N 108.3E	PCN 6			RODN
	22	121200	12.4N 108.6E	PCN 6			PGTW
	23	121600	13.0N 107.8E	PCN 6			PGTW
	24	122107	12.8N 107.6E	PCN 5			RPMK
	25	122247	13.1N 107.2E	PCN 5			RPMK
	26	130026	13.6N 107.1E	PCN 5			RPMK

NOTICE - THE ASTERISKS (*) INDICATE FIXES UNREPRESENTATIVE AND NOT USED FOR BEST TRACK PURPOSES.

TROPICAL DEPRESSION 23
BEST TRACK DATA

MO/DA/HR	BEST TRACK POSIT		BEST TRACK WIND	WARNING POSIT		WARNING WIND	WARNING ERRORS DST	WARNING ERRORS WIND	24 HOUR FORECAST POSIT		24 HOUR WIND	24 HOUR ERRORS DST	24 HOUR ERRORS WIND	48 HOUR FORECAST POSIT		48 HOUR WIND	48 HOUR ERRORS DST	48 HOUR ERRORS WIND	72 HOUR FORECAST POSIT		72 HOUR WIND	72 HOUR ERRORS DST	72 HOUR ERRORS WIND
101618Z	7.6	150.2	20	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
101700Z	8.2	149.4	20	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0	0.0	0.0	0.	-0.	0.
101706Z	8.7	148.6	25	8.7	148.5	25.	6.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
101712Z	9.3	147.7	25	9.1	147.5	25.	17.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
101718Z	9.8	146.9	25	9.5	146.6	25.	25.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
101800Z	10.3	146.2	20	10.3	146.3	20.	6.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.

	ALL FORECASTS WRNG	24-HR	48-HR	72-HR	TYPHOONS WHILE OVER 35 KTS WRNG	24-HR	48-HR	72-HR
AVG FORECAST POSIT ERROR	13.	0.	0.	0.	0.	0.	0.	0.
AVG RIGHT ANGLE ERROR	16.	0.	0.	0.	0.	0.	0.	0.
AVG INTENSITY MAGNITUDE ERROR	0.	0.	0.	0.	0.	0.	0.	0.
AVG INTENSITY BIAS	0.	0.	0.	0.	0.	0.	0.	0.
NUMBER OF FORECASTS	4	0	0	0	0	0	0	0

DISTANCE TRAVELED BY TROPICAL CYCLONE IS 287. NM

AVERAGE SPEED OF TROPICAL CYCLONE IS 10. KNOTS

TROPICAL DEPRESSION TD23W
FIX POSITIONS FOR CYCLONE NO. 23

SATELLITE FIXES

FIX NO.	TIME (Z)	FIX POSITION	ACCRY	DVORAK CODE	COMMENTS	SITE
1	141800	12.6N 155.8E	PCN 6	T1.5/1.5	INIT OBS	PGTW
2	142023	12.3N 154.1E	PCN 5			PGTW
3	152002	11.6N 153.2E	PCN 5	T0.5/0.5	INIT OBS EXP LLCC	PGTW
4	160300	11.5N 152.2E	PCN 6	T1.5/1.5	INIT OBS	PGTW
5	161600	7.1N 150.4E	PCN 6	T1.0/1.0	INIT OBS	PGTW
6	161800	7.4N 150.2E	PCN 6			PGTW
* 7	162100	7.4N 151.4E	PCN 6			PGTW
8	170821	9.1N 148.1E	PCN 6			PGTW
* 9	171200	6.9N 147.6E	PCN 6		ULCC FIX	PGTW
* 10	171243	6.8N 147.7E	PCN 6		ULCC FIX	PGTW
11	171822	9.6N 146.3E	PCN 6	T1.0/1.0-/S0.0/26HRS	ULCC FIX	PGTW

AIRCRAFT FIXES

FIX NO.	TIME (Z)	FIX POSITION	FLT LVL	700MB HGT	OBS MSLP	MAX-SFC-WND VEL/BRG/RNG	MAX-FLT-LVL-WND DIR/VEL/BRG/RNG	ACCRY NAV/MET	EYE SHAPE	EYE ORIEN- DIAM/TATION	EYE TEMP (C) OUT/ IN/ DP/SST	MSN NO.
1	170600	8.7N 148.5E	1500FT		998	25 170 30	230 28 170 30	1 5			+27 +27 +20 25	1

NOTICE - THE ASTERISKS (*) INDICATE FIXES UNREPRESENTATIVE AND NOT USED FOR BEST TRACK PURPOSES.

TYPHOON THAD BEST TRACK DATA

MO/DA/HR	BEST TRACK POSIT		BEST TRACK WIND	WARNING POSIT		WARNING WIND	WARNING ERRORS DST	WARNING ERRORS WIND	24 HOUR FORECAST POSIT		24 HR WIND	24 HR ERRORS DST	24 HR ERRORS WIND	48 HOUR FORECAST POSIT		48 HR WIND	48 HR ERRORS DST	48 HR ERRORS WIND	72 HOUR FORECAST POSIT		72 HR WIND	72 HR ERRORS DST	72 HR ERRORS WIND
101806Z	8.7	150.1	20	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
101812Z	9.7	149.6	25	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
101818Z	10.8	149.1	30	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
101900Z	11.9	148.5	30	11.2	147.2	25.	87.	-5.	14.0	142.7	50.	255.	-5.	15.8	137.9	65.	487.	-35.	16.4	132.9	90.	900.	-30.
101906Z	13.1	147.9	35	13.0	147.9	35.	6.	0.	15.8	143.6	50.	166.	-15.	16.8	138.6	65.	456.	-45.	17.5	133.4	90.	951.	-30.
101912Z	14.3	147.4	40	14.1	147.1	45.	21.	5.	16.9	142.7	60.	182.	-15.	18.7	138.0	70.	438.	-45.	20.7	134.2	95.	935.	-20.
101918Z	15.5	146.7	45	15.4	146.1	45.	35.	0.	18.9	141.5	60.	179.	-30.	21.3	137.0	70.	447.	-50.	24.9	135.0	90.	911.	-20.
102000Z	16.7	146.1	55	16.7	145.9	55.	11.	0.	21.0	143.3	70.	49.	-30.	25.6	143.2	70.	112.	-50.	29.9	147.6	65.	308.	-35.
102006Z	17.8	145.6	65	17.8	145.7	65.	6.	0.	22.0	144.2	75.	50.	-35.	26.0	144.5	80.	150.	-40.	30.2	149.2	75.	383.	-15.
102012Z	19.0	145.0	75	19.0	145.4	70.	23.	-5.	23.2	144.4	80.	49.	-35.	26.4	145.2	85.	241.	-30.	31.2	152.4	70.	369.	-10.
102018Z	20.3	144.3	90	20.3	144.5	80.	11.	-10.	24.3	143.4	85.	52.	-35.	29.3	147.0	80.	219.	-30.	33.2	155.9	65.	328.	-10.
102100Z	21.6	143.9	100	21.8	144.0	100.	13.	0.	29.0	146.7	80.	191.	-40.	35.2	153.8	70.	212.	-30.	0.0	0.0	0.	-0.	0.
102106Z	22.7	143.7	110	22.9	143.6	95.	13.	-15.	28.2	144.8	75.	124.	-45.	33.0	151.7	65.	202.	-25.	0.0	0.0	0.	-0.	0.
102112Z	23.7	143.7	115	23.6	143.7	95.	6.	-20.	28.0	145.8	80.	173.	-35.	33.6	153.6	60.	251.	-20.	0.0	0.0	0.	-0.	0.
102118Z	24.9	144.1	120	24.8	144.0	120.	8.	0.	29.7	147.9	90.	168.	-20.	34.9	157.7	75.	212.	0.	0.0	0.0	0.	-0.	0.
102200Z	26.1	145.2	120	26.0	145.1	115.	8.	-5.	31.9	152.9	85.	19.	-15.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
102206Z	27.3	146.9	120	27.2	146.7	110.	12.	-10.	33.0	155.6	80.	25.	-10.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
102212Z	28.6	149.0	115	28.6	149.0	100.	0.	-15.	34.1	160.1	75.	85.	-5.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
102218Z	30.1	151.1	110	30.2	151.2	95.	8.	-15.	35.7	163.1	65.	59.	-10.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
102300Z	31.7	153.2	100	31.5	153.0	110.	16.	10.	37.1	164.5	70.	110.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
102306Z	33.4	155.7	90	33.2	155.2	100.	28.	10.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
102312Z	34.6	158.5	80	34.8	157.9	90.	32.	10.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
102318Z	35.3	162.0	75	35.9	161.1	75.	57.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
102400Z	35.5	165.6	70	35.5	165.5	75.	5.	5.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.

	ALL FORECASTS WRNG	24-HR	48-HR	72-HR	TYPHOONS WHILE OVER 35 KTS WRNG	24-HR	48-HR	72-HR
AVG FORECAST POSIT ERROR	19.	114.	286.	635.	16.	114.	286.	635.
AVG RIGHT ANGLE ERROR	18.	86.	178.	319.	14.	86.	178.	319.
AVG INTENSITY MAGNITUDE ERROR	7.	22.	33.	21.	7.	22.	33.	21.
AVG INTENSITY BIAS	-3.	-22.	-33.	-21.	-3.	-22.	-33.	-21.
NUMBER OF FORECASTS	21	17	12	8	20	17	12	8

DISTANCE TRAVELED BY TROPICAL CYCLONE IS 2362. NM

AVERAGE SPEED OF TROPICAL CYCLONE IS 17. KNOTS

TYPHOON THAD FIX POSITIONS FOR CYCLONE NO. 24

SATELLITE FIXES

	FIX NO.	TIME (Z)	FIX POSITION		ACCRY	DVORAK CODE	COMMENTS	SITE
	1	172342	8.0N	150.4E	PCN 5	T1.0/1.0	INIT OBS ULCC FIX	PGTW
	2	180525	9.0N	149.7E	PCN 6			PGTW
	3	180759	8.7N	150.2E	PCN 6		ULCC FIX	PGTW
	4	181200	9.2N	149.7E	PCN 6		ULCC FIX	PGTW
	5	181223	9.6N	149.5E	PCN 6		ULCC FIX	PGTW
	6	181809	10.5N	148.8E	PCN 6	T2.0/2.0 /D1.0/24HRS	ULCC FIX	PGTW
*	7	182039	10.5N	147.5E	PCN 6		ULCC FIX	PGTW
*	8	182201	10.5N	147.2E	PCN 6		ULCC FIX	PGTW
	9	182321	11.9N	147.5E	PCN 6		ULCC FIX	PGTW
*	10	190103	11.5N	146.5E	PCN 5	T2.0/2.0 /D1.0/25HRS		PGTW
*	11	190600	13.3N	146.6E	PCN 6			PGTW
	12	190919	13.8N	147.0E	PCN 6			PGTW
	13	191202	13.8N	146.8E	PCN 4			PGTW
	14	191600	15.1N	146.4E	PCN 6			PGTW
	15	191757	16.2N	146.4E	PCN 4	T3.0/3.0 /D1.0/24HRS		PGTW
	16	192018	16.4N	146.2E	PCN 4			PGTW
	17	192137	16.7N	145.6E	PCN 3			PGTW
	18	200043	16.8N	146.2E	PCN 3	T3.5/3.5 /D1.5/24HRS		PGTW
	19	200300	17.2N	145.9E	PCN 4			PGTW
	20	200641	17.8N	145.9E	PCN 3			PGTW
	21	200858	18.5N	145.5E	PCN 4			PGTW
	22	201200	18.9N	145.4E	PCN 4			PGTW
	23	201304	19.1N	145.1E	PCN 4			PGTW
	24	201600	20.1N	144.5E	PCN 4			PGTW
	25	201800	20.3N	143.7E	PCN 4	T5.0/5.0 /D2.0/24HRS		PGTW
	26	201957	20.9N	144.0E	PCN 2			PGTW
	27	202112	21.1N	144.0E	PCN 2			PGTW
	28	210000	21.6N	143.9E	PCN 2			PGTW
	29	210023	21.6N	143.8E	PCN 1	T5.5/5.5-/D2.0/24HRS		PGTW
	30	210300	22.2N	143.7E	PCN 2			PGTW
	31	210600	22.8N	143.6E	PCN 2			PGTW
	32	210629	22.8N	143.7E	PCN 2			PGTW
	33	210837	23.1N	143.5E	PCN 2			PGTW
	34	210950	23.4N	143.8E	PCN 4			PGTW
	35	211200	23.6N	143.8E	PCN 2		EYE DIA 30NM	PGTW
	36	211303	23.7N	143.7E	PCN 1			PGTW
	37	211600	24.3N	144.0E	PCN 2			PGTW
	38	211800	24.9N	144.2E	PCN 2	T6.5/6.5-/D1.5/24HRS		PGTW
	39	211914	25.1N	144.4E	PCN 1			PGTW
	40	212100	25.6N	144.6E	PCN 2			PGTW
	41	212229	25.6N	145.0E	PCN 2			PGTW
	42	220003	26.0N	145.3E	PCN 2	T6.0/6.0-/D0.5/24HRS	EYE FIX	PGTW
	43	220300	26.6N	145.7E	PCN 2			PGTW
	44	220600	27.2N	146.7E	PCN 2			PGTW
	45	220616	27.3N	147.0E	PCN 2			PGTW
	46	220815	27.4N	147.2E	PCN 2			PGTW
	47	220900	27.8N	147.8E	PCN 2			PGTW
	48	220926	28.1N	148.1E	PCN 2			PGTW
	49	221200	28.6N	149.2E	PCN 4			PGTW
	50	221243	28.8N	149.1E	PCN 1		EYE FIX	PGTW
	51	221600	29.4N	150.5E	PCN 6		ULCC FIX	PGTW
	52	221800	30.3N	151.3E	PCN 6	T4.5/5.5 /W1.5/24HRS		PGTW
*	53	222204	32.0N	153.6E	PCN 6		ULCC FIX	PGTW
	54	222342	31.9N	153.0E	PCN 5	T4.5/6.0 /W1.5/24HRS		PGTW
	55	222342	32.6N	153.1E	PCN 3	T3.5/3.5	INIT OBS	RODN
	56	230300	33.4N	154.5E	PCN 6			PGTW
	57	231600	34.9N	160.9E	PCN 6		EXP LLCC	PGTW
	58	231800	35.2N	161.8E	PCN 6		EXP LLCC	PGTW
	59	232141	35.5N	164.3E	PCN 4			PGTW
	60	232322	35.5N	165.3E	PCN 5	T3.5/4.5 /W1.0/24HRS		PGTW

AIRCRAFT FIXES

FIX NO.	TIME (Z)	FIX POSITION		FLT LVL	700MB HGT	OBS MSLP	MAX-SFC-WND VEL/BRG/RNG			MAX-FLT-LVL-WND DIR/VEL/BRG/RNG				ACCRY NAV/MET		EYE SHAPE	EYE ORIEN- DIAM/TATION			EYE TEMP (C) OUT/ IN/ DP/SST			MSN NO.
1	190728	13.6N	147.9E	1500FT		990	45	120	72	310	30	210	70	10	2					+24	+25	+24	2
2	192305	16.4N	146.2E	1500FT		981	60	320	10	180	59	090	10	6	1	CIRCULAR	15			+24	+25	+25	3
3	200154	17.0N	145.9E	700MB	2917	978	75	310	10	180	57	0	17	10	2	CIRCULAR	20			+11	+18	+ 9	3
4	200543	17.7N	145.8E	700MB	2879		70	020	10	170	49	070	27	5	4	CIRCULAR	20			+ 6	+17	+12	4
5	200800	18.2N	145.5E	700MB	2866		90	020	15	100	46	010	37	3	5					+ 6	+15	+11	4
6	202039	20.8N	144.2E	700MB	2718	957	100	110	15	190	79	070	64	15	1	CIRCULAR	10			+16	+16	+12	6
7	202313	21.6N	144.0E	700MB	2662	948	100	220	10	210	75	360	10	10	1	CIRCULAR	8			+17	+19	+15	6
8	210743	22.9N	143.9E	700MB	2535	936	90	160	20	210	90	110	10	20	10	CONCENTRIC	10	25		+16	+18		7
9	211025	23.3N	143.6E	700MB	2536					080	76	350	12	10	10	CONCENTRIC	10	30		+16	+21		7
10	212052	25.5N	144.5E	700MB	2544		120	180	10	190	95	130	36	15	8	ELLIPTICAL	20	15	060	+13	+20	+14	8
11	212338	26.0N	145.1E	700MB	2552	935	110	110	10	320	99	240	30	6	8	CIRCULAR	20			+18	+17	+14	8
12	220536	27.2N	146.6E	700MB	2526	925	110	180	15	200	107	080	17	9	1	CIRCULAR	15			+19	+22		9
13	220806	27.8N	147.5E	700MB	2581	941				300	80	260	33	10	1	CIRCULAR	20			+17	+20		9
14	222310	31.4N	152.8E	700MB	2895	979	120	160	36	280	85	160	36	10	1					+19	+21	+ 8	10

NOTICE - THE ASTERISKS (*) INDICATE FIXES UNREPRESENTATIVE AND NOT USED FOR BEST TRACK PURPOSES

SUPER TYPHOON VANESSA
BEST TRACK DATA

MO/DA/HR	BEST TRACK POSIT	BEST TRACK WIND	WARNING POSIT	WARNING WIND	WARNING ERRORS DST	WARNING ERRORS WIND	24 HOUR FORECAST POSIT	24 HOUR WIND	24 HOUR ERRORS DST	24 HOUR ERRORS WIND	48 HOUR FORECAST POSIT	48 HOUR WIND	48 HOUR ERRORS DST	48 HOUR ERRORS WIND	72 HOUR FORECAST POSIT	72 HOUR WIND	72 HOUR ERRORS DST	72 HOUR ERRORS WIND
102200Z	7.5 159.2	25	0.0 0.0	0.	-0.	0.	0.0 0.0	0.	-0.	0.	0.0 0.0	0.	-0.	0.	0.0 0.0	0.	-0.	0.
102206Z	8.1 157.8	25	0.0 0.0	0.	-0.	0.	0.0 0.0	0.	-0.	0.	0.0 0.0	0.	-0.	0.	0.0 0.0	0.	-0.	0.
102212Z	8.6 156.4	25	0.0 0.0	0.	-0.	0.	0.0 0.0	0.	-0.	0.	0.0 0.0	0.	-0.	0.	0.0 0.0	0.	-0.	0.
102218Z	9.1 154.9	30	9.5 154.3	30.	43.	0.	11.9 148.8	45.	91.	-15.	14.0 144.2	65.	155.	-20.	17.5 142.2	90.	419.	-40.
102300Z	9.4 153.4	35	9.4 153.9	30.	30.	-5.	11.5 148.9	50.	98.	-20.	13.9 144.3	70.	237.	-25.	17.5 142.3	90.	496.	-50.
102306Z	9.8 152.0	40	9.7 152.1	35.	8.	-5.	11.9 146.6	55.	59.	-20.	14.4 142.2	70.	212.	-40.	17.0 139.1	90.	377.	-60.
102312Z	10.1 150.5	50	10.2 150.7	45.	13.	-5.	12.3 145.3	65.	82.	-15.	14.4 140.7	75.	210.	-45.	16.2 137.0	90.	306.	-65.
102318Z	10.4 149.0	60	10.7 149.0	55.	18.	-5.	12.9 143.9	75.	106.	-10.	14.6 139.4	90.	227.	-40.	16.4 135.8	115.	282.	-35.
102400Z	10.8 147.4	70	10.6 147.6	70.	17.	0.	12.4 142.7	90.	137.	-5.	14.7 138.5	105.	263.	-35.	17.0 135.0	115.	270.	-30.
102406Z	11.3 145.8	75	11.2 146.1	75.	19.	0.	12.8 140.2	95.	95.	-15.	15.3 135.5	110.	164.	-40.	17.8 132.3	120.	143.	-20.
102412Z	11.8 144.0	80	12.0 144.1	75.	13.	-5.	14.1 137.7	95.	35.	-25.	16.1 133.0	110.	75.	-45.	18.4 129.3	120.	25.	-15.
102418Z	12.3 142.2	85	12.4 142.1	85.	8.	0.	14.9 135.7	105.	13.	-25.	16.9 131.1	115.	27.	-35.	18.6 127.1	125.	141.	-10.
102500Z	12.8 140.4	95	12.8 140.4	90.	0.	-5.	14.8 134.7	100.	50.	-40.	16.7 130.5	115.	32.	-30.	19.6 128.7	130.	75.	0.
102506Z	13.4 138.7	110	13.4 138.8	110.	6.	0.	15.3 133.1	120.	33.	-30.	17.7 129.7	130.	13.	-10.	20.5 128.7	135.	95.	10.
102512Z	14.1 137.1	120	14.0 137.3	125.	13.	5.	15.6 132.6	140.	57.	-15.	18.4 128.7	130.	46.	-5.	23.0 128.6	120.	147.	0.
102518Z	14.8 135.5	130	15.0 135.6	130.	13.	0.	17.8 130.4	140.	83.	-10.	21.2 128.0	130.	116.	-5.	25.2 131.0	120.	158.	5.
102600Z	15.3 134.0	140	15.5 134.0	140.	12.	0.	18.9 128.8	140.	133.	-5.	23.3 128.4	125.	173.	-5.	27.5 133.8	105.	241.	-5.
102606Z	15.7 132.7	150	16.2 132.6	140.	31.	-10.	19.7 128.1	140.	145.	0.	24.1 129.1	125.	171.	0.	28.4 134.6	105.	263.	-5.
102612Z	16.0 131.7	155	16.3 131.6	155.	19.	0.	18.8 127.8	145.	91.	10.	23.3 128.5	130.	158.	10.	28.2 134.2	115.	276.	10.
102618Z	16.5 130.9	150	16.7 130.8	155.	13.	5.	19.2 127.6	145.	101.	10.	23.7 128.8	130.	204.	15.	28.2 136.0	115.	251.	20.
102700Z	17.2 130.3	145	17.1 130.3	145.	6.	0.	20.0 128.0	130.	92.	0.	24.6 130.0	115.	234.	5.	29.2 137.6	100.	289.	20.
102706Z	17.9 129.8	140	17.9 129.8	140.	0.	0.	21.1 127.9	130.	124.	5.	25.5 131.2	115.	273.	5.	29.8 138.9	100.	401.	30.
102712Z	18.8 129.4	135	18.6 129.3	135.	13.	0.	22.7 128.2	125.	164.	5.	26.7 133.0	110.	289.	5.	0.0 0.0	0.	-0.	0.
102718Z	19.7 129.3	135	19.6 129.1	135.	13.	0.	23.8 129.1	125.	190.	10.	27.8 135.0	110.	293.	15.	0.0 0.0	0.	-0.	0.
102800Z	20.6 129.5	130	20.6 129.3	135.	11.	5.	24.8 130.7	120.	202.	10.	28.7 136.8	105.	328.	25.	0.0 0.0	0.	-0.	0.
102806Z	21.4 130.1	125	21.3 130.2	125.	8.	0.	25.2 135.1	110.	78.	0.	28.7 143.0	100.	208.	30.	0.0 0.0	0.	-0.	0.
102812Z	22.2 131.1	120	22.3 131.2	120.	8.	0.	26.7 138.0	110.	90.	5.	0.0 0.0	0.	-0.	0.	0.0 0.0	0.	-0.	0.
102818Z	22.9 132.4	115	23.2 132.4	115.	18.	0.	27.8 140.4	100.	78.	5.	0.0 0.0	0.	-0.	0.	0.0 0.0	0.	-0.	0.
102900Z	23.5 134.1	110	23.5 134.2	120.	6.	10.	25.7 143.3	95.	157.	15.	0.0 0.0	0.	-0.	0.	0.0 0.0	0.	-0.	0.
102906Z	24.2 136.0	110	24.2 136.2	115.	11.	5.	27.2 147.2	90.	183.	20.	0.0 0.0	0.	-0.	0.	0.0 0.0	0.	-0.	0.
102912Z	25.2 138.1	105	25.1 138.0	105.	8.	0.	0.0 0.0	0.	-0.	0.	0.0 0.0	0.	-0.	0.	0.0 0.0	0.	-0.	0.
102918Z	26.5 140.3	95	26.4 140.3	95.	6.	0.	0.0 0.0	0.	-0.	0.	0.0 0.0	0.	-0.	0.	0.0 0.0	0.	-0.	0.
103000Z	28.3 143.0	80	28.0 143.1	90.	19.	10.	0.0 0.0	0.	-0.	0.	0.0 0.0	0.	-0.	0.	0.0 0.0	0.	-0.	0.
103006Z	30.2 146.6	70	30.3 147.0	75.	22.	5.	0.0 0.0	0.	-0.	0.	0.0 0.0	0.	-0.	0.	0.0 0.0	0.	-0.	0.

	ALL FORECASTS WRNG	ALL FORECASTS 24-HR	ALL FORECASTS 48-HR	ALL FORECASTS 72-HR	TYPHOONS WHILE OVER 35 KTS WRNG	TYPHOONS WHILE OVER 35 KTS 24-HR	TYPHOONS WHILE OVER 35 KTS 48-HR	TYPHOONS WHILE OVER 35 KTS 72-HR
AVG FORECAST POSIT ERROR	14.	102.	179.	245.	13.	102.	179.	245.
AVG RIGHT ANGLE ERROR	11.	68.	106.	165.	10.	68.	106.	165.
AVG INTENSITY MAGNITUDE ERROR	3.	13.	21.	23.	3.	13.	21.	23.
AVG INTENSITY BIAS	0.	-6.	-12.	-13.	0.	-6.	-12.	-13.
NUMBER OF FORECASTS	31	27	23	19	30	27	23	19

DISTANCE TRAVELED BY TROPICAL CYCLONE IS 3125. NM

AVERAGE SPEED OF TROPICAL CYCLONE IS 16. KNOTS

SUPER TYPHOON VANESSA
FIX POSITIONS FOR CYCLONE NO. 25

SATELLITE FIXES

FIX NO.	TIME (Z)	FIX POSITION	ACCRY	DVORAK CODE	COMMENTS	SITE
1	201200	3.9N 162.5E	PCN 6			PGTW
2	201600	4.1N 162.4E	PCN 6			PGTW
3	210000	4.4N 162.2E	PCN 6	T1.0/1.0	INIT OBS	PGTW
4	210300	4.9N 162.4E	PCN 6		ULCC FIX	PGTW
5	210600	5.2N 161.7E	PCN 6			PGTW
6	220003	7.4N 159.1E	PCN 6	T2.0/2.0 /D1.0/24HRS		PGTW
7	220300	7.7N 158.6E	PCN 6		ULCC FIX	PGTW
8	220600	8.1N 158.1E	PCN 6		ULCC FIX	PGTW
9	220816	8.3N 157.6E	PCN 6		ULCC FIX	PGTW
10	221200	8.8N 156.0E	PCN 6			PGTW
11	221243	8.7N 155.7E	PCN 5			PGTW
12	221600	9.4N 154.6E	PCN 6	T2 5/2.5	INIT OBS	PGTW
* 13	221719	9.2N 153.7E	PCN 6			PGTW
* 14	221800	9.1N 153.8E	PCN 6			PGTW
15	222024	9.5N 154.4E	PCN 4			PGTW
16	222342	9.0N 153.8E	PCN 5	T3 0/3.0 /D1.0/24HRS		PGTW
17	230300	9.6N 153.0E	PCN 6			PGTW
18	230604	9.8N 152.0E	PCN 5			PGTW
19	230754	9.8N 151.4E	PCN 4			PGTW
20	230902	10.1N 151.2E	PCN 4			PGTW
21	231223	10.2N 150.6E	PCN 3			PGTW
22	231600	10.5N 149.6E	PCN 4	T4.0/4.0 /D1.5/24HRS		PGTW
23	231849	10.7N 148 7E	PCN 3			PGTW
24	232035	10.4N 147.9E	PCN 3			PGTW
25	232322	10.5N 147.5E	PCN 5			PGTW
26	240300	11.4N 147.2E	PCN 4	T5.0/5.0 /D2.0/24HRS		PGTW
27	240551	11.5N 145.9E	PCN 3			PGTW
28	240551	11.7N 145.3E	PCN 3	T4.0/4.0	INIT OBS	RODN
29	240838	11 9N 145.0E	PCN 4			PGTW
30	240915	11.8N 145.1E	PCN 4			PGTW
31	241203	12.0N 144.0E	PCN 4			PGTW
32	241600	12.2N 142.7E	PCN 4			PGTW
33	241836	12.4N 141.8E	PCN 4	T5.0/5.0 /D1.0/26HRS		PGTW
* 34	241836	13.1N 142.1E	PCN 4			RPMK
35	242013	12.3N 141.3E	PCN 3			PGTW
36	242117	12.4N 141.0E	PCN 3			PGTW
37	250043	12.8N 140.2E	PCN 2	T5.5/5.5 /D0.5/21HRS		PGTW
38	250300	13.1N 139.7E	PCN 2			PGTW
39	250539	13.7N 138.4E	PCN 2			PGTW
40	250900	13.6N 138.0E	PCN 2			PGTW
41	250955	14.0N 138.0E	PCN 2			PGTW
42	251200	14.3N 137.5E	PCN 2			PGTW
43	251323	14.3N 136.9E	PCN 2			PGTW
44	251600	14.7N 136.1E	PCN 2	T6.5/6.5 /D1.5/22HRS		PGTW
45	251800	14.9N 135.6E	PCN 2			PGTW
46	251823	15.1N 135.3E	PCN 2			RODN
47	251823	14.8N 135.6E	PCN 2			PGTW
48	252100	15.2N 135.0E	PCN 2			PGTW
49	252133	15.2N 134.8E	PCN 2			PGTW
50	252233	15.2N 134.5E	PCN 2			PGTW
51	260023	15.5N 133.5E	PCN 1	T7.0/7.0	INIT OBS	RODN
52	260023	15.5N 133.8E	PCN 1	T7 0/7.0 /D1.5/24HRS		PGTW
53	260300	15.8N 133.3E	PCN 2			PGTW
54	260708	15.9N 132.6E	PCN 1			PGTW
55	260900	16.0N 132.2E	PCN 2			PGTW
56	260931	16.0N 131.9E	PCN 1			PGTW
57	261200	16.0N 131.8E	PCN 2			PGTW
58	261304	16.0N 131.6E	PCN 2			PGTW
59	261600	16.2N 131.3E	PCN 2	T7.0/7.0-/D0.5/24HRS		PGTW
60	261800	16.4N 131.1E	PCN 2			PGTW
61	262100	16.8N 130.8E	PCN 2			RODN
62	262100	16.7N 130.8E	PCN 2			PGTW
63	262112	16.8N 130.8E	PCN 2			RODN
64	262112	16.7N 130.8E	PCN 2			PGTW
65	262209	17.0N 130.7E	PCN 2			PGTW
66	270000	17.3N 130.4E	PCN 2			PGTW
67	270144	17.4N 130.5E	PCN 2			RODN
68	270144	17.4N 130.3E	PCN 1	T7.0/7.0-/S0.0/25HRS	EYE DIA 9NM	PGTW
69	270300	17.6N 130.1E	PCN 2		EYE DIA 9NM	PGTW
70	270656	18.0N 129.8E	PCN 1			PGTW
71	270952	18.4N 129.5E	PCN 2			PGTW
72	271048	18.6N 129.4E	PCN 2			PGTW
73	271200	18.8N 129.5E	PCN 2			PGTW
74	271425	18.9N 129.4E	PCN 2			PGTW

75	271600	19.4N 129.4E	PCN 2	T6.5/7.0 /W0.5/24HRS		PGTW
76	271800	19.7N 129.4E	PCN 2			PGTW
77	271940	20.0N 129.3E	PCN 2			PGTW
78	271940	20.0N 129.5E	PCN 2			RPMK
79	272051	20.0N 129.2E	PCN 1			PGTW
80	272326	20.6N 129.5E	PCN 2			PGTW
81	272326	20.5N 129.6E	PCN 2	T6.5/6.5	INIT OBS	RODN
82	280124	20.7N 129.6E	PCN 1	T6.5/6.5 /W1.5/24HRS	EYE DIA 6NM	PGTW
83	280124	20.8N 129.6E	PCN 1			RODN
84	280300	20.9N 129.8E	PCN 2		EYE DIA 18NM	PGTW
85	280643	21.4N 130.3E	PCN 1		EYE DIA 12NM	PGTW
86	280931	21.9N 130.8E	PCN 1			PGTW
87	281023	22.3N 131.0E	PCN 1			PGTW
88	281200	22.4N 131.1E	PCN 2			PGTW
89	281405	22.5N 131.5E	PCN 1			PGTW
90	281600	22.8N 131.9E	PCN 2	T5.0/6.0 /W1.5/24HRS		PGTW
91	281800	23.0N 132.4E	PCN 2			PGTW
92	281928	23.0N 132.8E	PCN 1			PGTW
93	282100	23.4N 133.2E	PCN 2			PGTW
94	282301	23.3N 133.9E	PCN 6	T5.0/6.0 /W1.5/22HRS		RODN
95	282302	23.4N 133.9E	PCN 1			PGTW
96	290000	23.4N 134.0E	PCN 2			PGTW
97	290104	23.5N 134.5E	PCN 1	T4.5/5.5 /W1.0/24HRS		PGTW
98	290300	23.8N 134.9E	PCN 2			PGTW
99	290630	24.2N 136.3E	PCN 2			PGTW
100	290900	24.6N 137.0E	PCN 4			PGTW
101	290910	24.6N 137.0E	PCN 4		ULCC FIX	PGTW
102	290959	24.8N 137.5E	PCN 4			PGTW
103	291200	25.1N 138.1E	PCN 4			PGTW
104	291344	25.5N 139.0E	PCN 3			PGTW
105	291600	26.5N 139.5E	PCN 6		ULCC FIX	PGTW
106	291800	26.7N 140.2E	PCN 6	T4.0/5.0 /W1.0/26HRS		PGTW
107	291915	26.8N 140.7E	PCN 5		ULCC FIX	PGTW
108	292009	26.9N 141.3E	PCN 3			PGTW
109	292237	27.5N 142.5E	PCN 4			PGTW
110	300044	28.3N 143.3E	PCN 4	T3.5/4.5 /W1.0/24HRS		PGTW
111	300618	30.5N 147.4E	PCN 4		ULCC 31.2N 147.7E	PGTW
112	300848	31.0N 147.8E	PCN 6			PGTW
113	301200	32.7N 151.2E	PCN 6		ULCC 34.7N 152.3E	PGTW
114	301800	34.5N 154.5E	PCN 6			PGTW

AIRCRAFT FIXES

FIX NO.	TIME (Z)	FIX POSITION	FLT LVL	700MB HGT	OBS MSLP	MAX-SFC-WND VEL/BRG/RNG	MAX-FLT-LVL-WND DIR/VEL/BRG/RNG	ACCRY NAV/MET	EYE SHAPE	EYE DIAM/ORIENTATION	EYE TEMP (C) OUT/ IN/ DP/SST	MSN NO.
1	230518	9.6N 152.3E	1500FT		996	35 120 40	050 35 350 40	6 2			+25 +25 +22	1
2	230751	9.8N 151.6E	1500FT		996	35 060 30	080 56 300 90	10 2			+24 +25 +22	1
3	232054	10.5N 148.2E	700MB	2971		65 320 20	200 60 140 15	6 5	CIRCULAR	45	+18 +21 +10	3
4	232345	10.6N 147.6E	700MB	2971	984	80 250 15	150 60 040 30	8 5	CIRCULAR	45	+15 +21 +11	3
5	240547	11.2N 146.0E	700MB	2963	985	55 130 30	080 55 340 100	4 3	CIRCULAR	20	+13 +14 +11	4
6	240825	11.7N 145.1E	700MB	2953	983	75 060 30	130 75 060 56	4 5	ELLIPTICAL	40 20 090	+12 +14 +10	4
7	242033	12.3N 141.5E	700MB	2797	967	90 040 26	140 74 040 32	10 8	CIRCULAR	35	+12 +14	5
8	250556	13.3N 138.8E	700MB	2500	934	120 330 10	360 100 230 10	6 1	ELLIPTICAL	25 20 360	+12 +25 + 6	6
9	250833	13.5N 138.2E	700MB	2365	916	130 060 19	180 110 110 28	6 1	CIRCULAR	15	+16 +28 + 5	6
10	252318	15.4N 134.2E	700MB	2160	892	130 300 8	030 81 310 13	5 3	CIRCULAR	10	+13 +31	7
11	260049	15.5N 133.9E	700MB	2107		130 040 07	200 107 100 10	10 2	CIRCULAR	10	+14 +29	7
12	260841	15.8N 132.2E	700MB	2026	883	130 030 10	100 115 020 19	6 1	CIRCULAR	10	+13 +30 + 7	9
13	261114	15.9N 131.8E	700MB	2022	879		200 115 130 10	5 1	CIRCULAR	10	+16 +29 + 8	9
14	262031	16.6N 130.6E	700MB	2096	887	45 320 90	080 122 020 15	8 1	CONCENTRIC	10 40	+16 +20 +16	10
15	262326	17.1N 130.4E	700MB	2164	894	75 120 90	280 110 210 04	6 5	CONCENTRIC	10 30	+17 +12 +17	10
16	270830	18.3N 129.6E	700MB	2244		50 090 16	290 109 220 43	3 2	CIRCULAR	20	+16 +19 +18	11
17	271106	18.6N 129.3E	700MB	2237	904		190 100 120 60	10 1	CONCENTRIC	20 40	+15 +18 +18	11
18	280218	20.7N 129.6E	700MB	2338	915	65 240 60	310 98 240 7	10 5	CIRCULAR	15	+12 +18 +18	13
19	280831	21.8N 130.7E	700MB	2380	919	50 300 120	010 75 300 9	10 1	CIRCULAR	30	+17 +20 +16	14
20	281135	22.3N 131.0E	700MB	2454	929		230 105 120 70	10 2	CIRCULAR	20	+16 +19 +13	14
21	282032	23.3N 133.2E	700MB	2356			090 80 020 8	8 2	CIRCULAR	15	+13 +17 +14	15
22	282334	23.5N 134.1E	700MB	2418	923	90 160 30	330 110 270 17	6 1	CIRCULAR	15	+13 +15 +15	15
23	290910	24.6N 137.2E	700MB	2528	936	110 150 54	220 111 150 49	8 2			+13 +16 +15	16
24	291156	25.2N 138.0E	700MB	2572	940		210 97 250 25	8 2			+16 +19 +15	16
25	292049	27.2N 141.3E	700MB	2730	957	90 250 23	240 105 160 57	5 10	CIRCULAR	50	+14 +22	17
26	292352	28.3N 142.9E	700MB	2761	961	90 210 30	300 78 030 12	7 10			+14 +19	17
27	301054	32.3N 150.2E	700MB	2867			260 92 220 115	10 10			+14 +22	19

RADAR FIXES

FIX NO.	TIME (Z)	FIX POSITION	RADAR	ACCRY	EYE SHAPE	EYE DIAM	RADOB-CODE ASWAR TDDFF	COMMENTS	RADAR POSITION	SITE WMO NO.
1	240226	11.5N 146.1E	LAND						13.5N 144.9E	
2	240235	11.3N 146.7E	LAND	GOOD				MOV 1220	13.6N 144.9E	91218
3	240306	11.7N 145.7E	LAND					MOVG NW	13.5N 144.8E	91212
4	240400	11.5N 145.8E	LAND						13.5N 144.8E	91212
5	240615	11.6N 145.9E	LAND		CIRCULAR	30		EYE MOSTLY OPN	13.6N 144.9E	91218
6	240735	11.5N 145.8E	LAND	GOOD					13.6N 144.9E	91218
7	240835	11.6N 145.3E	LAND	FAIR					13.6N 144.9E	91218
8	240935	11.7N 145.3E	LAND	FAIR					13.6N 144.9E	91218
9	241035	11.9N 144.6E	LAND	FAIR					13.6N 144.9E	91218
10	241235	12.2N 143.9E	LAND	FAIR					13.6N 144.9E	91218
11	241335	12.1N 143.7E	LAND	GOOD	ELLIPTICAL	40			13.6N 144.9E	91218
12	241435	12.0N 143.5E	LAND	GOOD	ELLIPTICAL	35			13.6N 144.9E	91218
13	241535	12.1N 143.3E	LAND	FAIR					13.6N 144.9E	91218

NOTICE - THE ASTERISKS (*) INDICATE FIXES UNREPRESENTATIVE AND NOT USED FOR BEST TRACK PURPOSES.

TYPHOON WARREN BEST TRACK DATA

	BEST TRACK			WARNING			ERRORS		24 HOUR FORECAST			ERRORS		48 HOUR FORECAST			ERRORS		72 HOUR FORECAST			ERRORS	
MO/DA/HR	POSIT		WIND	POSIT		WIND	DST	WIND	POSIT		WIND	DST	WIND	POSIT		WIND	DST	WIND	POSIT		WIND	DST	WIND
102300Z	11.1	116.0	25	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
102306Z	11.6	116.2	25	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
102312Z	12.0	116.3	30	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
102318Z	12.4	116.3	35	12.2	115.9	30.	26.	-5.	12.9	114.8	50.	83.	0.	13.3	113.2	55.	140.	-5.	13.9	111.1	60.	216.	-5.
102400Z	12.9	116.2	35	12.8	115.7	30.	30.	-5.	13.2	115.0	45.	50.	-5.	13.8	114.0	55.	63.	-5.	14.4	112.4	60.	134.	-5.
102406Z	13.6	116.1	40	13.4	116.2	45.	13.	5.	14.1	115.7	60.	18.	5.	14.8	114.8	70.	13.	5.	15.5	113.2	80.	105.	15.
102412Z	14.2	115.7	45	13.5	116.1	50.	48.	5.	14.6	115.6	60.	12.	5.	15.9	114.5	70.	48.	5.	16.8	112.7	80.	192.	15.
102418Z	14.2	115.3	50	14.3	115.3	55.	6.	5.	15.4	113.5	70.	110.	10.	16.6	111.3	80.	211.	15.	18.0	109.3	80.	435.	15.
102500Z	13.8	115.6	50	14.0	115.5	60.	13.	10.	15.0	114.5	70.	27.	10.	15.8	113.2	80.	91.	15.	16.9	111.4	80.	339.	15.
102506Z	14.2	116.0	55	14.5	115.8	60.	21.	5.	15.4	114.8	70.	32.	5.	16.4	113.5	75.	109.	10.	17.4	111.6	80.	373.	15.
102512Z	14.6	115.8	55	14.9	115.2	60.	39.	5.	16.5	114.0	70.	91.	5.	18.1	112.1	75.	263.	10.	19.5	110.0	75.	521.	10.
102518Z	14.6	115.2	60	15.0	115.0	55.	27.	-5.	16.0	113.8	45.	71.	-20.	16.9	112.3	45.	251.	-20.	17.5	111.2	45.	431.	-20.
102600Z	14.6	114.7	60	15.3	115.3	55.	55.	-5.	16.4	114.8	45.	79.	-20.	17.4	114.1	45.	207.	-20.	18.2	113.2	45.	333.	-15.
102606Z	14.9	114.6	65	14.6	114.4	65.	21.	0.	15.1	113.3	70.	99.	5.	15.7	112.3	75.	318.	10.	16.3	111.2	80.	385.	25.
102612Z	15.1	114.6	65	15.0	114.3	65.	18.	0.	15.0	114.3	65.	85.	0.	16.2	112.9	75.	307.	10.	16.8	112.3	75.	306.	20.
102618Z	15.1	114.6	65	15.5	114.3	65.	30.	0.	16.1	114.1	70.	138.	5.	17.2	113.8	70.	284.	5.	18.0	113.4	75.	259.	25.
102700Z	15.1	114.6	65	15.0	114.9	65.	18.	0.	16.1	114.6	70.	149.	5.	16.9	114.2	70.	247.	10.	17.5	113.6	75.	218.	30.
102706Z	15.3	115.0	65	15.5	115.0	65.	12.	0.	15.9	115.0	70.	163.	5.	16.9	114.4	76.	216.	21.	17.6	113.4	75.	213.	30.
102712Z	15.4	115.7	65	15.5	115.3	65.	24.	0.	16.5	116.1	70.	130.	5.	17.6	116.5	75.	142.	20.	18.7	116.6	75.	212.	35.
102718Z	15.5	116.4	65	15.6	115.5	65.	52.	0.	16.6	116.1	70.	148.	5.	17.8	116.5	75.	147.	25.	18.7	116.6	75.	245.	35.
102800Z	15.5	117.1	65	15.2	117.7	65.	39.	0.	16.3	121.9	45.	220.	-15.	20.0	125.3	55.	564.	10.	23.4	129.0	65.	989.	30.
102806Z	15.6	117.8	65	15.5	117.9	55.	8.	-10.	15.9	121.2	40.	199.	-15.	17.1	124.9	45.	506.	0.	19.9	129.4	55.	974.	25.
102812Z	15.7	118.2	65	15.7	118.1	55.	6.	-10.	16.7	119.3	45.	134.	-10.	18.0	118.6	50.	237.	10.	18.9	116.7	55.	373.	25.
102818Z	15.5	118.4	65	15.6	118.0	60.	24.	-5.	16.5	118.2	65.	96.	15.	17.4	116.7	65.	181.	25.	17.6	114.7	70.	286.	45.
102900Z	15.4	118.2	60	15.6	118.0	60.	17.	0.	16.0	118.0	65.	83.	20.	17.0	116.3	70.	183.	35.	17.6	114.4	75.	311.	50.
102906Z	15.4	117.8	55	15.5	117.8	60.	6.	5.	16.0	117.4	65.	73.	20.	16.2	115.4	70.	158.	40.	16.5	113.4	75.	259.	50.
102912Z	15.4	117.4	55	15.5	117.3	55.	8.	0.	15.7	115.5	50.	25.	10.	15.8	113.5	45.	118.	15.	0.0	0.0	0.	-0.	0.
102918Z	15.4	117.0	50	15.4	116.5	55.	29.	5	15.6	114.7	50.	36.	10.	15.6	112.7	45.	127.	20.	0.0	0.0	0.	-0.	0
103000Z	15.4	116.7	45	15.4	116.6	50.	6.	5.	15.4	115.0	45.	63.	10.	15.9	113.0	45.	182.	20.	0.0	0.0	0.	-0.	0.
103006Z	15.4	116.3	45	15.4	116.2	50.	6.	5.	15.5	114.5	45.	92.	15.	16.0	113.0	45.	221.	20.	0.0	0.0	0.	-0.	0.
103012Z	15.3	115.6	40	15.4	115.8	45.	13.	5.	15.5	114.1	45.	121.	15.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
103018Z	15.0	114.8	40	15.4	115.3	45.	38.	5.	15.5	113.3	40.	137.	15.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
103100Z	14.8	114.1	35	14.7	114.1	30.	6.	-5.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
103106Z	14.4	113.4	30	14.4	113.4	25.	0.	-5.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
103112Z	14.0	112.7	30	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
103118Z	13.6	112.0	25	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
110100Z	13.3	111.4	25	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
110106Z	13.0	110.8	25	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.

	ALL FORECASTS				TYPHOONS WHILE OVER 35 KTS			
	WRNG	24-HR	48-HR	72-HR	WRNG	24-HR	48-HR	72-HR
AVG FORECAST POSIT ERROR	21.	95.	205.	353.	22.	93.	215.	328.
AVG RIGHT ANGLE ERROR	9.	53.	128.	219.	9.	54.	139.	207.
AVG INTENSITY MAGNITUDE ERROR	4.	10.	15.	24.	4.	9.	13.	20.
AVG INTENSITY BIAS	0.	4.	11.	20.	1.	3.	9.	15.
NUMBER OF FORECASTS	31	29	27	23	30	26	22	18

DISTANCE TRAVELED BY TROPICAL CYCLONE IS 1111. NM

AVERAGE SPEED OF TROPICAL CYCLONE IS 5. KNOTS

TYPHOON WARREN FIX POSITIONS FOR CYCLONE NO. 26

SATELLITE FIXES

FIX NO.	TIME (Z)	FIX POSITION	ACCRY	DVORAK CODE	COMMENTS	SITE
1	230300	11.5N 115.7E	PCN 4	T1.0/1.0	INIT OBS EXP LLCC	PGTW
2	230600	11.5N 116.1E	PCN 4		EXP LLCC	PGTW
3	230743	11.7N 116.4E	PCN 3	T1.5/1.5	INIT OBS EXP LLCC	RPMK
4	231200	12.0N 116.5E	PCN 6			PGTW
5	231600	12.2N 116.2E	PCN 6			PGTW
6	231800	12.4N 116.6E	PCN 6	T2.5/2.5	INIT OBS	PGTW
7	232030	12.5N 116.0E	PCN 5		ULCC FIX	RPMK
8	232100	12.6N 115.8E	PCN 6		ULCC FIX	PGTW
9	232216	12.7N 116.0E	PCN 3	T3.0/3.0	INIT OBS	RODN
10	232321	12.7N 115.3E	PCN 5			RODN
11	232322	12.6N 116.2E	PCN 5			RPMK
12	240245	13.0N 116.0E	PCN 5	T2.5/2.5 /D1.0/19HRS		RPMK
13	240300	13.2N 116.4E	PCN 4	T3.5/3.5 /D2.5/24HRS		PGTW
14	240722	13.1N 115.9E	PCN 3	T3.0/3.0 /D1.5/24HRS		RPMK
15	240733	13.4N 115.7E	PCN 6			PGTW
16	240900	13.7N 115.9E	PCN 6			PGTW
17	241056	13.8N 115.9E	PCN 5			RODN
18	241200	13.3N 115.2E	PCN 5			RPMK
19	241200	14.1N 115.8E	PCN 6			PGTW
* 20	241526	13.2N 115.1E	PCN 5			RPMK
21	241600	14.3N 115.3E	PCN 6			PGTW
22	241800	14.4N 115.0E	PCN 6	T4.0/4.0 /D1.5/24HRS		PGTW
23	242018	14.0N 115.1E	PCN 5			RPMK
24	242258	13.8N 115.4E	PCN 6			PGTW
* 25	250224	14.7N 116.5E	PCN 3	T4.0/4.0 /D1.0/28HRS		RODN
26	250721	14.8N 115.8E	PCN 4			PGTW
27	250721	14.8N 115.8E	PCN 3	T3.0/3.0+/S0.0/24HRS	EXP LLCC	RPMK
28	251034	14.6N 115.6E	PCN 3			RPMK
* 29	251136	14.9N 114.9E	PCN 3		EXP LLCC	RPMK
* 30	251136	14.0N 113.7E	PCN 4			RODN
31	251200	14.8N 115.3E	PCN 6			PGTW
* 32	251505	14.7N 114.5E	PCN 3			RODN
33	251600	15.0N 115.0E	PCN 6	T3.0/4.0+/W1.0/22HRS		PGTW
*	252005	15.0N 112.3E	PCN 5		ULCC FIX	RPMK
*	252315	15.3N 115.6E	PCN 3			RPMK
36	260000	14.6N 115.0E	PCN 6		EXP LLCC	PGTW
37	260205	14.5N 114.9E	PCN 3	T3.0/3.0 /S0.0/19HRS	EXP LLCC	RPMK
38	260300	14.8N 114.8E	PCN 6	T3.0/3.5 /S0.0/20HRS	EXP LLCC	PGTW
39	260600	15.0N 114.7E	PCN 4			PGTW
40	260900	15.6N 113.8E	PCN 6			PGTW
41	261112	15.0N 114.9E	PCN 3			RPMK
* 42	261112	13.9N 113.3E	PCN 6		ULCC FIX	RODN
43	261445	15.2N 115.2E	PCN 5			RPMK
44	261600	15.4N 115.6E	PCN 6	T2.5/3.0 /W0.5/24HRS		PGTW
45	261800	15.6N 115.0E	PCN 6			PGTW
* 46	262253	15.4N 115.4E	PCN 4	T3.5/4.0 /W0.5/21HRS	EXP LLCC	RODN
47	262350	15.0N 115.1E	PCN 3		EXP LLCC	RPMK
48	270144	15.2N 115.0E	PCN 3		EXP LLCC	PGTW
49	270144	15.2N 114.9E	PCN 4		EXP LLCC	RODN
50	270300	15.3N 115.2E	PCN 4	T3.0/3.0+/S0.0/24HRS	EXP LLCC	PGTW
51	270600	15.5N 115.0E	PCN 4		EXP LLCC	PGTW
52	270835	15.0N 115.1E	PCN 3		EXP LLCC	RPMK
53	270900	15.6N 115.4E	PCN 6		EXP LLCC	PGTW
54	271048	15.4N 115.7E	PCN 6			PGTW
55	271134	15.0N 115.0E	PCN 5	T3.0/3.0 /S0.0/31HRS		RPMK
* 56	272326	15.2N 117.9E	PCN 3	T3.5/3.5 /D0.5/15HRS		RPMK
57	272326	15.3N 117.0E	PCN 6			PGTW
58	272326	15.2N 117.6E	PCN 6			RODN
59	280124	15.3N 118.2E	PCN 5			PGTW
* 60	280124	15.3N 118.1E	PCN 3			RPMK
61	280300	15.4N 117.9E	PCN 6	T4.0/4.0-/D1.0/24HRS		PGTW
62	280600	15.8N 118.2E	PCN 6			PGTW
63	280825	15.4N 118.0E	PCN 5	T3.5/3.5-/D0.5/24HRS		RPMK

64	281112	15.6N 118.3E	PCN 5			RPMK
65	281112	15.3N 118.3E	PCN 4			RODN
66	281405	15.5N 118.0E	PCN 5			RPMK
67	281800	15.5N 118.3E	PCN 6	T4.0/4.0	INIT OBS	PGTW
68	281805	15.4N 118.1E	PCN 4			RPMK
69	281928	15.5N 118.4E	PCN 5			RPMK
70	282100	15.4N 118.3E	PCN 6			PGTW
71	282302	15.2N 117.5E	PCN 3	T4.0/4.0 /D0.5/24HRS		RPMK
72	282302	15.3N 117.7E	PCN 5			PGTW
* 73	290000	15.2N 116.9E	PCN 6			PGTW
74	290245	15.2N 117.6E	PCN 3			RPMK
75	290245	15.3N 117.9E	PCN 3			RODN
76	290300	15.4N 117.6E	PCN 6	T4.0/4.0 /S0.0/24HRS		PGTW
77	290600	15.5N 117.5E	PCN 6		ULCC FIX	PGTW
78	290812	15.4N 117.0E	PCN 3	T4.5/4.5 /D1.0/24HRS		RPMK
79	290900	15.9N 117.0E	PCN 6		ULCC FIX	PGTW
80	291140	15.2N 117.0E	PCN 5			RPMK
81	291140	15.5N 116.9E	PCN 6			RODN
82	291200	15.4N 116.8E	PCN 6			PGTW
83	291250	15.5N 116.8E	PCN 4			PGTW
84	291525	15.3N 116.8E	PCN 5			RPMK
85	291600	15.5N 116.6E	PCN 6	T3.5/4.0 /W0.5/22HRS		PGTW
86	291800	15.5N 116.2E	PCN 6			PGTW
87	292057	15.5N 115.9E	PCN 5			RPMK
88	300000	15.4N 116.9E	PCN 4			PGTW
89	300018	15.4N 116.6E	PCN 5	T3.5/3.5 /S0.0/22HRS		RODN
90	300019	15.6N 115.9E	PCN 5			RPMK
91	300225	15.5N 116.1E	PCN 3	T3.0/4.0+/W1.0/24HRS		RPMK
92	300600	15.4N 116.0E	PCN 4	T3.0/4.0 /W1.0/26HRS	EXP LLCC	PGTW
93	300759	15.3N 115.8E	PCN 3		EXP LLCC	RODN
94	300800	15.3N 115.9E	PCN 3	T3.0/4.0 /W1.0/30HRS	EXP LLCC	RPMK
95	300900	15.3N 115.9E	PCN 4		EXP LLCC	PGTW
96	301115	15.4N 115.9E	PCN 3			RPMK
97	301116	15.1N 115.4E	PCN 6			RODN
98	301505	15.2N 115.5E	PCN 3			RPMK
99	301600	15.2N 115.3E	PCN 6	T2.5/3.0 /W1.0/24HRS		PGTW
100	301800	15.1N 115.5E	PCN 6			PGTW
101	302044	15.2N 114.4E	PCN 5		EXP LLCC	RODN
102	302354	14.8N 114.5E	PCN 3			RPMK
103	310204	14.8N 113.6E	PCN 3	T2.5/3.5 /W1.0/26HRS		RODN
104	310205	14.9N 114.0E	PCN 3	T2.5/3.0 /W0.5/24HRS		RPMK
*105	310300	15.2N 114.7E	PCN 4			PGTW
106	310600	14.6N 113.6E	PCN 4	T1.5/2.5 /W1.5/24HRS		PGTW
107	312100	14.3N 112.0E	PCN 6			PGTW
108	010000	13.5N 111.5E	PCN 5			PGTW
109	010145	13.1N 111.1E	PCN 3	T1.5/2.0 /W1.0/24HRS	EXP LLCC	RPMK
110	010300	12.9N 111.0E	PCN 4		EXP LLCC	PGTW
111	011800	13.5N 109.7E	PCN 6			PGTW
112	020600	14.0N 105.0E	PCN 6		ULCC FIX	PGTW

AIRCRAFT FIXES

FIX NO.	TIME (Z)	FIX POSITION	FLT LVL	700MB HGT	OBS MSLP	MAX-SFC-WND VEL/BRG/RNG	MAX-FLT-LVL-WND DIR/VEL/BRG/RNG	ACCRY NAV/MET	EYE SHAPE	EYE ORIEN- DIAM/TATION	EYE TEMP (C) OUT/ IN/ DP/SST	MSN NO.
1	250216	14.0N 115.8E	1500FT		985	50 360 40	230 47 180 24	12 5			+29 +29	1
2	260316	14.7N 114.5E	1500FT		980	65 200 90	100 60 050 37	4 5			+24 +26 +26	2
3	260551	14.5N 114.4E	700MB	2951	982	75 130 40	220 55 120 60	4 5			+17 +20 + 8	2
4	270032	14.9N 114.7E	700MB	2977		70 080 30	220 77 120 56	4 4			+21 +21	3
5	270302	15.3N 114.8E	700MB	2951	979	40 010 90	320 57 040 83	6 5				3
6	270951	15.4N 115.2E	1500FT		983	45 050 60	270 68 190 60	5 5			+22 +25 +19	4
7	271227	15.2N 115.5E	700MB	2892	976		240 59 130 86	5 5			+ 9 +18 +12	4
8	280257	15.5N 117.4E	700MB	2905	976	50 290 30	010 53 300 20	15 3			+24 +25	5
9	280601	15.7N 117.8E	700MB	2902		65 090 20	200 58 100 60	10 2			+ 7 +18	5
10	280957	15.7N 118.3E	700MB	2918		30 070 50	210 51 100 95	5 7			+12 +15 +13	6
11	281135	15.7N 118.1E	700MB	2929	976		310 60 240 15	8 10	CIRCULAR	35	+12 +17 +11	6
12	290941	15.5N 117.5E	1500FT		990	45 070 30	070 55 130 50	5 5			+22 +25 +23	7
13	291143	15.5N 117.3E	700MB	3003	984		290 52 220 75	5 5			+ 9 +15 +15	7
14	292045	15.4N 116.7E	700MB	3004			310 40 050 90	8 10			+13 +16 + 7	8
15	292333	15.3N 116.7E	1500FT		994	50 030 130	120 51 030 48	8 5			+23 +26 +23 28	8
16	300233	15.5N 116.0E	700MB	3071	995	50 330 105	070 44 330 55	5 5			+24 +25 +22 28	8
17	300856	15.4N 116.0E	1500FT		992	40 070 60	140 40 070 60	10 8			+24 +26 +24	9
18	301129	15.3N 115.3E	700MB	3056			100 42 360 100	10 10			+12 +15 + 6	9
19	301410	15.2N 115.1E	700MB	3057			200 42 110 45	10 10			+12 +15 + 8	9
20	302232	14.9N 114.4E	1500FT			25 180 30	240 39 180 15	15 7			+23 +23 +22	10
21	310128	14.6N 113.9E	1500FT			25 030 60	120 34 030 60	10 5			+23 +23 +23	10
22	310545	14.4N 113.5E	1500FT		999	30 060 45	290 34 020 60	6 10			+20 +24 +20 28	11

RADAR FIXES

FIX NO	TIME (Z)	FIX POSITION	RADAR	ACCRY	EYE SHAPE	EYE DIAM	RADOB-CODE ASWAR TDDFF	COMMENTS	RADAR POSITION	SITE WMO NO.
1	280500	15.2N 117.5E	LAND				1041/ /////		16.3N 120.6E	98321
2	280600	15.3N 117.8E	LAND				1042/ 57020		16.3N 120.6E	98321
3	280900	15.5N 118.0E	LAND				10412 49005	EYE 60 PCT OPN	16.3N 120.6E	98321
4	281200	16.1N 118.2E	LAND				///// /////		16.6N 120.3E	
5	281500	15.6N 117.8E	LAND				10212 42305	EYE 60 PCT CIR OPN NNW	16.3N 120.6E	98321
* 6	281800	15.6N 117.8E	LAND				///// /////		16.3N 120.6E	98321
7	281800	15.8N 118.4E	LAND				///// /////		16.6N 120.3E	
8	281900	15.5N 117.8E	LAND				10412 42405		16.3N 120.6E	98321
* 9	290100	15.4N 116.9E	LAND				4//// 52705		16.3N 120.6E	98321
* 10	290300	15.4N 117.3E	LAND				4//// 42704		16.3N 120.6E	98321
* 11	290400	15.4N 117.2E	LAND				10312 42705	EYE 60 PCT CIR OPN E	16.3N 120.6E	98321
* 12	290800	15.4N 116.9E	LAND				4//// 52705		16.3N 120.6E	98321

SYNOPTIC FIXES

FIX NO.	TIME (Z)	FIX POSITION	INTENSITY ESTIMATE	NEAREST DATA (NM)	COMMENTS
1	251800	15.0N 115.0E	055	005	SHIP

NOTICE - THE ASTERISKS (*) INDICATE FIXES UNREPRESENTATIVE AND NOT USED FOR BEST TRACK PURPOSES.

TYPHOON AGNES
BEST TRACK DATA

	BEST TRACK			WARNING					24 HOUR FORECAST					48 HOUR FORECAST					72 HOUR FORECAST				
							ERRORS					ERRORS					ERRORS					ERRORS	
MO/DA/HR	POSIT		WIND	POSIT		WIND	DST	WIND	POSIT		WIND	DST	WIND	POSIT		WIND	DST	WIND	POSIT		WIND	DST	WIND
103012Z	3.0	146.1	25	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
103018Z	3.3	145.8	25	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
103100Z	3.6	145.6	25	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
103106Z	3.9	145.3	25	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
103112Z	4.4	144.9	25	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
103118Z	4.8	144.5	30	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
110100Z	5.4	143.8	35	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
110106Z	5.9	143.0	45	5.8	143.0	45.	6.	0.	7.8	139.6	65.	77.	5.	9.5	133.9	90.	8.	-10.	10.0	128.0	105.	56.	-10.
110112Z	6.8	141.8	50	6.7	141.7	50.	8.	0.	8.5	136.0	70.	77.	5.	9.0	130.1	90.	158.	-20.	9.0	124.1	100.	223.	-15.
110118Z	7.4	140.4	55	7.5	140.3	55.	8.	0.	9.6	134.7	75.	106.	-5.	10.2	128.7	95.	161.	-15.	10.3	122.6	80.	196.	-40.
110200Z	7.8	139.4	55	8.0	139.2	55.	17.	0.	9.7	133.7	75.	96.	-15.	10.3	127.0	95.	183.	-15.	11.7	121.8	80.	130.	-20.
110206Z	8.3	138.4	60	8.4	138.3	60.	8.	0.	9.8	133.3	80.	48.	-20.	10.4	126.8	100.	118.	-15.	11.8	121.6	80.	49.	-5.
110212Z	8.6	137.3	65	8.6	137.3	60.	0.	-5.	9.7	132.8	80.	8.	-30.	10.6	127.3	105.	13.	-10.	11.8	122.2	80.	82.	10.
110218Z	8.8	136.3	80	8.7	136.3	70.	6.	-10.	9.8	131.8	105.	24.	-5.	10.5	126.2	115.	48.	-5.	11.0	121.3	80.	130.	0.
110300Z	9.1	135.2	90	9.2	135.2	90.	6.	0.	10.3	130.3	125.	17.	15.	11.2	125.9	135.	113.	35.	12.2	121.5	80.	223.	-10.
110306Z	9.4	134.0	100	9.5	133.9	100.	8.	0.	10.6	128.9	130.	8.	15.	11.4	124.5	120.	124.	35.	12.6	120.2	75.	258.	-20.
110312Z	9.6	132.7	110	9.6	132.6	110.	6.	0.	10.7	127.8	130.	24.	15.	11.9	122.7	105.	112.	35.	13.2	118.9	65.	287.	-35.
110318Z	9.8	131.4	110	9.8	131.5	110.	6.	0.	10.9	126.4	130.	40.	10.	12.1	121.8	90.	141.	10.	13.7	117.5	70.	304.	-30.
110400Z	10.1	130.1	110	10.0	130.2	115.	8.	5.	11.1	125.5	125.	91.	25.	12.3	121.2	80.	205.	-10.	14.3	116.4	75.	299.	-25.
110406Z	10.5	128.8	115	10.4	128.9	115.	8.	0.	11.5	124.0	105.	94.	20.	12.8	119.7	70.	229.	-25.	13.8	114.4	80.	245.	-20.
110412Z	10.8	127.4	115	10.8	127.5	115.	6.	0.	12.0	123.1	100.	136.	30.	13.3	118.3	75.	252.	-25.	14.4	113.4	85.	256.	0.
110418Z	11.2	125.8	120	11.2	126.0	125.	12.	5.	12.7	120.5	70.	74.	-10.	13.9	115.8	80.	207.	-20.	14.8	111.1	95.	194.	45.
110500Z	11.5	124.0	100	11.6	124.2	110.	13.	10.	13.5	118.2	70.	83.	-20.	15.9	113.2	80.	172.	-20.	18.0	108.0	90.	223.	65.
110506Z	11.6	122.4	85	11.7	122.2	90.	13.	5.	13.3	116.3	80.	56.	-15.	15.7	111.3	90.	125.	-10.	18.3	106.3	100.	197.	80.
110512Z	11.8	120.8	70	11.9	120.8	75.	6.	5.	13.6	115.2	90.	82.	-10.	16.2	110.4	100.	145.	15.	19.0	105.6	110.	186.	95.
110518Z	12.1	119.4	80	12.2	119.5	90.	8.	10.	13.9	114.1	105.	111.	5.	16.7	109.4	110.	171.	60.	0.0	0.0	0.	-0.	0.
110600Z	12.2	117.7	90	12.2	117.7	80.	0.	-10.	13.6	112.2	90.	53.	-10.	14.9	108.1	70.	111.	45.	0.0	0.0	0.	-0.	0.
110606Z	12.5	115.8	95	12.6	116.1	85.	19.	-10.	13.6	110.7	95.	34.	-5.	14.2	106.8	50.	128.	30.	0.0	0.0	0.	-0.	0.
110612Z	12.9	114.0	100	12.9	114.1	95.	6.	-5.	14.3	107.0	50.	116.	-35.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
110618Z	13.3	112.3	100	13.2	112.4	90.	8.	-10.	14.7	106.7	40.	68.	-10.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
110700Z	13.7	111.3	100	13.6	111.4	95.	8.	-5.	14.6	108.4	40.	128.	15.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
110706Z	13.9	110.2	100	13.8	110.3	100.	8.	0.	14.7	107.2	25.	138.	5.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
110712Z	14.2	109.0	85	14.2	109.1	85.	6.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
110718Z	14.3	107.8	50	14.2	108.1	60.	18.	10.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
110800Z	14.7	106.2	25	14.4	107.5	25.	78.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
110806Z	15.3	104.9	20	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
110812Z	16.3	104.0	15	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.

	ALL FORECASTS				TYPHOONS WHILE OVER 35 KTS			
	WRNG	24-HR	48-HR	72-HR	WRNG	24-HR	48-HR	72-HR
AVG FORECAST POSIT ERROR	11.	72.	139.	197.	9.	66.	141.	195.
AVG RIGHT ANGLE ERROR	7.	23.	54.	69.	7.	23.	56.	59.
AVG INTENSITY MAGNITUDE ERROR	4.	14.	22.	29.	4.	15.	21.	19.
AVG INTENSITY BIAS	-0.	-1.	3.	4.	-0.	-2.	-1.	-12.
NUMBER OF FORECASTS	28	25	21	18	27	23	19	15

DISTANCE TRAVELED BY TROPICAL CYCLONE IS 2666. NM

AVERAGE SPEED OF TROPICAL CYCLONE IS 12. KNOTS

TYPHOON AGNES
FIX POSITIONS FOR CYCLONE NO. 27

SATELLITE FIXES

FIX NO.	TIME (Z)	FIX POSITION	ACCRY	DVORAK CODE	COMMENTS	SITE
1	300848	2.8N 146.3E	PCN 6		ULCC FIX	PGTW
2	310300	3.8N 145.5E	PCN 6	T1.5/1.5	INIT OBS	PGTW
3	310600	3.8N 145.4E	PCN 6			PGTW
4	310827	4.3N 144.9E	PCN 5			PGTW
5	311200	4.4N 144.9E	PCN 6			PGTW
6	311600	4.9N 144.8E	PCN 6	T1.0/1.0	INIT OBS	PGTW
7	311800	5.2N 144.7E	PCN 6			PGTW
8	312107	5.3N 144.0E	PCN 5			PGTW
9	010003	5.4N 144.1E	PCN 5			PGTW
10	010300	5.8N 143.8E	PCN 6	T2.5/2.5 /D1.0/24HRS		PGTW
11	010553	5.7N 142.8E	PCN 5			PGTW
12	010846	6.5N 142.4E	PCN 6			PGTW
13	011200	6.9N 141.8E	PCN 4			PGTW
14	011243	6.9N 141.2E	PCN 6			RODN
15	011600	7.4N 141.0E	PCN 6			PGTW
16	011838	7.5N 140.3E	PCN 3	T3.5/3.5 /D2.5/27HRS		PGTW
17	012046	7.6N 140.0E	PCN 3			PGTW
18	020124	7.7N 139.7E	PCN 3	T3.5/3.5	INIT OBS	RPMK
19	020124	8.0N 139.3E	PCN 3		EYEWALL FRMG N-E-SE	PGTW
20	020300	8.1N 138.9E	PCN 4	T4.0/4.0 /D1.5/24HRS		PGTW
21	020722	8.5N 138.2E	PCN 3			PGTW
22	020926	8.4N 137.6E	PCN 4			PGTW
23	021003	8.6N 137.7E	PCN 6			PGTW
24	021200	8.5N 137.3E	PCN 6		ULCC FIX	PGTW
25	021224	8.6N 137.2E	PCN 6			PGTW
26	021600	8.6N 136.7E	PCN 2	T5.0/5.0 /D1.5/22HRS		PGTW
27	021800	8.6N 136.3E	PCN 2			PGTW
28	021825	8.7N 136.2E	PCN 4			PGTW
29	022025	9.1N 135.6E	PCN 4		ULCC FIX	PGTW
30	022242	9.2N 135.3E	PCN 2			PGTW
31	030104	9.3N 135.0E	PCN 1	T4.5/4.5 /D1.0/24HRS		RPMK
32	030104	9.2N 135.0E	PCN 1			PGTW
33	030300	9.4N 134.5E	PCN 4	T5.0/5.0 /D1.0/24HRS		PGTW
34	030710	9.4N 133.7E	PCN 1			PGTW
35	030905	9.5N 133.1E	PCN 1			PGTW
36	030939	9.6N 133.0E	PCN 2			PGTW
37	031200	9.5N 132.6E	PCN 2			PGTW
38	031345	9.5N 132.3E	PCN 2			PGTW
39	031600	9.5N 131.9E	PCN 2	T5.5/5.5 /D0.5/24HRS		PGTW
40	031800	9.7N 131.5E	PCN 2			PGTW
41	031954	9.8N 131.2E	PCN 2			PGTW
42	032100	9.9N 130.8E	PCN 2			PGTW
43	032145	9.9N 130.7E	PCN 2			PGTW
44	032217	10.0N 130.5E	PCN 1			PGTW
45	040044	10.0N 129.9E	PCN 1		EYE DIA 6NM	PGTW
46	040300	10.3N 129.5E	PCN 2	T5.5/5.5-/D0.5/24HRS	EYE FIX	PGTW
47	040600	10.5N 128.9E	PCN 2		EYE FIX	PGTW
48	040657	10.5N 128.6E	PCN 1	T6.0/6.0 /D1.5/30HRS	EYE DIA 6NM	RPMK
49	040657	10.6N 128.7E	PCN 1		EYE FIX	PGTW
50	040900	10.7N 128.2E	PCN 2		EYE DIA 11NM	PGTW
51	041025	10.7N 127.8E	PCN 1		EYE DIA 8NM	PGTW
52	041056	10.8N 127.8E	PCN 1		EYE FIX	RPMK
53	041056	10.8N 127.7E	PCN 1		EYE FIX	PGTW
54	041200	10.8N 127.5E	PCN 2		EYE DIA 6NM	PGTW
55	041325	11.1N 127.0E	PCN 1		EYE DIA 78NM	PGTW
56	041800	11.3N 125.7E	PCN 2	T6.5/6.5-/D1.0/26HRS	EYE DIA 12NM	PGTW
57	041942	11.3N 125.1E	PCN 1		EYE FIX	PGTW
58	042124	11.4N 124.5E	PCN 3			PGTW
59	042334	11.4N 124.2E	PCN 3			RPMK
60	042334	11.4N 123.9E	PCN 3	T5.0/5.0	INIT OBS	RODN
61	050000	11.5N 124.0E	PCN 4			PGTW
62	050205	11.5N 123.3E	PCN 1		EYE FIX	PGTW
63	050205	11.6N 123.5E	PCN 1	T5.0/6.0 /W1.0/19HRS	EYE DIA 25NM	RPMK
64	050300	11.7N 123.1E	PCN 2	T5.0/5.5+/W0.5/24HRS		PGTW

65	050645	11.6N 122.0E	PCN 3			PGTW
66	050645	11.4N 122.5E	PCN 3			RPMK
67	051004	11.8N 121.3E	PCN 3			PGTW
68	051200	11.9N 120.9E	PCN 4			PGTW
69	051446	11.9N 120.0E	PCN 3			RPMK
70	051600	12.1N 119.9E	PCN 4			PGTW
71	051800	12.3N 119.5E	PCN 4	T5.0/5.5+/W1.5/24HRS		PGTW
72	051928	12.5N 118.8E	PCN 3			PGTW
73	052100	12.6N 118.4E	PCN 4			PGTW
74	052244	12.4N 117.9E	PCN 1	T5.0/5.0+/S0.0/23HRS	EYE FIX	RODN
75	052310	12.4N 117.8E	PCN 1	T5.0/5.0 /S0.0/21HRS	EYE DIA 30NM	RPMK
76	052310	12.5N 117.8E	PCN 1			PGTW
77	060145	12.5N 117.3E	PCN 1	T5.0/5.0 /S0.0/27HRS	EYE FIX	RPMK
78	060145	12.6N 117.2E	PCN 1			PGTW
79	060300	12.5N 116.9E	PCN 2	T5.0/5.0 /S0.0/24HRS		PGTW
80	060600	12.7N 115.8E	PCN 2			PGTW
81	060814	12.8N 115.1E	PCN 1		EYE FIX	RPMK
82	060814	12.5N 115.6E	PCN 1		EYE FIX	RODN
83	060900	12.9N 114.9E	PCN 2			PGTW
84	061124	12.9N 113.9E	PCN 3			RPMK
85	061124	13.0N 114.5E	PCN 3			RODN
86	061200	12.8N 113.9E	PCN 2			PGTW
87	061426	13.0N 113.6E	PCN 4			PGTW
88	061800	13.4N 112.5E	PCN 4	T4.5/5.0-/W0.5/24HRS		PGTW
89	062059	13.4N 112.4E	PCN 3			RPMK
90	062223	13.5N 111.8E	PCN 3			RPMK
91	070000	13.6N 111.5E	PCN 2			PGTW
92	070027	13.8N 111.3E	PCN 2			RODN
93	070300	13.7N 111.1E	PCN 2	T5.5/5.5-/D0.5/24HRS		PGTW
94	070306	13.8N 110.9E	PCN 1	T5.5/5.5-/D0.5/25HRS	EYE DIA 30NM	RPMK
95	070600	13.8N 110.4E	PCN 2			PGTW
96	070801	14.0N 109.7E	PCN 3			RPMK
97	070900	14.1N 109.9E	PCN 2			PGTW
98	071103	14.4N 109.1E	PCN 1			RPMK
99	071200	14.2N 109.1E	PCN 2			PGTW
100	071547	14.2N 108.8E	PCN 5			RPMK
101	071600	14.0N 108.0E	PCN 4			PGTW
102	071800	14.2N 108.0E	PCN 6		ULCC FIX	PGTW
103	072046	14.2N 107.0E	PCN 6		ULCC FIX	RODN
104	072100	14.3N 106.5E	PCN 6		ULCC FIX	PGTW
105	080000	14.6N 106.0E	PCN 6		ULCC FIX	PGTW
106	080003	15.4N 106.2E	PCN 5			RPMK
107	080300	15.4N 105.2E	PCN 6			PGTW
108	081200	16.5N 103.8E	PCN 6			PGTW

AIRCRAFT FIXES

FIX NO.	TIME (Z)	FIX POSITION	FLT LVL	700MB HGT	OBS MSLP	MAX-SFC-WND VEL/BRG/RNG	MAX-FLT-LVL-WND DIR/VEL/BRG/RNG	ACCRY NAV/MET	EYE SHAPE	EYE ORIEN- DIAM/TATION	EYE TEMP (C) OUT/ IN/ DP/SST	MSN NO.
1	010513	5.8N 143.0E	700MB	3015	996	50 030 5	170 48 090 10	9 1	CIRCULAR	15	+10 +13 +10	1
2	012032	7.5N 140.0E	700MB	3021			130 56 060 29	5 5	ELLIPTICAL	30 20 240	+10 +14 + 7	3
3	012325	7.7N 139.5E	700MB	3025	993	55 340 15	050 60 340 30	4 5	ELLIPTICAL	15 10 250	+14 + 7	3
4	020535	8.2N 138.5E	700MB	2994	988	60 360 10	060 65 360 11	10 10				5
5	020831	8.4N 138.0E	1500FT		987	60 260 10	280 28 220 33	10 10	CIRCULAR	20	+26 +28 +27	5
6	022117	9.0N 135.7E	700MB	2913	980	90 360 20		10 5	CIRCULAR	15	+15 +17 +10	6
7	022321	9.1N 135.3E	700MB	2889	978	100 330 10		10 1	CIRCULAR	10	+13 +16 +10	6
8	030532	9.4N 134.0E	700MB	2692	956	100 030 5	150 92 070 27	5 1	CIRCULAR	10	+16 +19 +10	7
9	030746	9.5N 133.5E	700MB	2666	951	110 330 5	240 37 160 25	8 1	CIRCULAR	10	+12 +18 +10	7
10	032005	9.9N 131.0E	700MB	2542			150 95 090 12	10 1	CIRCULAR	8	+11 +19 +10	8
11	032303	10.0N 130.3E	700MB	2445	926	100 200 6	050 93 300 10	10 1	CIRCULAR	6	+ 9 +21 +10	8
12	040850	10.7N 128.1E	700MB	2513		100 090 10	190 106 070 14	5 1	CONCENTRIC	10 30	+ 8 +15 +14	9
13	041127	10.8N 127.5E	700MB	2433	925		060 106 330 22	4 1	CONCENTRIC	08 25	+ 8 +19 +12	9
14	050900	11.5N 121.8E	700MB	2913		35 300 90	030 51 270 06	1 5			+ 4 + 7 + 2	10
15	051154	11.7N 120.9E	700MB	2909	977		050 70 300 54	10 5	CIRCULAR	15	+ 3 + 6	10
16	052048	12.1N 118.4E	700MB	2853			060 72 360 40	10 5			+ 8 +15 + 6	11
17	052324	12.1N 117.9E	700MB	2852	973	90 020 20	140 95 020 30	10 5	CIRCULAR	20	+ 9 +15 + 7	11
18	060843	12.7N 115.3E	700MB	2790		100 060 20	150 96 060 16	5 5	CIRCULAR	50	+11 +18 + 8	12
19	061136	12.9N 114.1E	700MB	2801	966		070 89 350 04	6 5	CIRCULAR	45	+11 +16 + 9	12

RADAR FIXES

	FIX NO.	TIME (Z)	FIX POSITION	RADAR	ACCRY	EYE SHAPE	EYE DIAM	RADOB-CODE ASWAR TDDFF	COMMENTS	RADAR POSITION	SITE WMO NO.
	1	050200	11.5N 123.4E	LAND				20963 52730		14.0N 124.3E	98447
*	2	050300	11.4N 123.8E	LAND				10802 4////		14.0N 124.3E	98447
	3	050400	11.5N 122.9E	LAND				10782 52730		14.0N 124.3E	98447
	4	050600	11.8N 122.5E	LAND				25/52 53037	EYE BECOMING LESS DISTINCT	14.0N 124.3E	98447

NOTICE - THE ASTERISKS (*) INDICATE FIXES UNREPRESENTATIVE AND NOT USED FOR BEST TRACK PURPOSES.

TYPHOON BILL
BEST TRACK DATA

MO/DA/HR	BEST TRACK POSIT		BEST TRACK WIND	WARNING POSIT		WARNING WIND	WARNING ERRORS DST	WARNING ERRORS WIND	24 HOUR FORECAST POSIT		24 HR WIND	24 HR ERRORS DST	24 HR ERRORS WIND	48 HOUR FORECAST POSIT		48 HR WIND	48 HR ERRORS DST	48 HR ERRORS WIND	72 HOUR FORECAST POSIT		72 HR WIND	72 HR ERRORS DST	72 HR ERRORS WIND
110800Z	14.3	153.9	25	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
110806Z	14.4	153.7	25	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
110812Z	14.1	153.5	30	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
110818Z	13.9	153.5	35	13.9	153.5	30.	0.	-5.	14.2	152.1	45.	105.	0.	14.5	150.1	65.	180.	5.	15.2	146.3	85.	249.	15.
110900Z	13.9	153.7	35	13.9	153.6	35.	6.	0.	14.3	152.3	50.	87.	0.	14.8	149.6	70.	187.	5.	15.3	145.5	90.	233.	20.
110906Z	13.9	153.8	40	14.1	153.7	40.	13.	0.	14.4	152.5	55.	70.	5.	15.1	149.6	75.	153.	10.	15.6	145.5	95.	184.	20.
110912Z	14.0	153.9	40	14.1	153.8	40.	8.	0.	14.4	152.5	55.	58.	0.	15.1	149.6	75.	116.	5.	15.6	145.5	95.	172.	15.
110918Z	14.2	153.9	45	14.0	153.8	45.	13.	0.	14.1	153.0	60.	27.	0.	14.2	150.9	75.	46.	5.	14.3	146.8	95.	168.	10.
111000Z	14.3	153.8	50	14.0	153.8	50.	18.	0.	14.3	153.0	55.	17.	-10.	14.5	150.7	75.	119.	5.	14.5	146.3	100.	257.	10.
111006Z	14.4	153.7	50	14.2	153.8	55.	13.	5.	14.3	152.8	65.	41.	0.	14.5	149.1	80.	113.	5.	14.6	144.1	105.	247.	15.
111012Z	14.5	153.5	55	14.2	153.7	55.	21.	0.	14.3	152.7	65.	82.	-5.	14.5	149.0	80.	197.	0.	14.6	144.0	105.	350.	10.
111018Z	14.5	153.2	60	14.2	153.6	55.	29.	-5.	14.4	152.0	65.	107.	-5.	14.5	148.3	80.	253.	-5.	14.5	143.2	105.	385.	5.
111100Z	14.5	152.8	65	14.3	152.7	70.	13.	5.	14.3	148.6	95.	59.	25.	14.3	142.1	115.	97.	25.	15.3	135.7	115.	152.	5.
111106Z	14.3	152.1	65	14.6	152.2	75.	19.	10.	14.6	148.0	100.	81.	25.	14.3	141.5	115.	121.	25.	16.1	135.2	115.	184.	-5.
111112Z	14.1	151.3	70	14.3	151.4	65.	13.	-5.	14.3	147.0	75.	104.	-5.	14.3	140.3	75.	155.	-20.	15.0	134.2	85.	138.	-40.
111118Z	13.7	150.3	70	13.9	150.4	65.	13.	-5	13.0	145.8	75.	94.	-10.	13.2	139.4	80.	151.	-20.	14.6	133.4	85.	142.	-45.
111200Z	13.4	149.0	70	13.6	149.2	70.	17.	0.	12.9	143.7	80.	83.	-10.	13.5	137.2	85.	119.	-25.	15.5	131.4	90.	92.	-40.
111206Z	13.3	147.6	75	13.3	147.7	75.	6.	0.	12.9	141.2	85.	50.	-5.	14.1	134.9	90.	76.	-30.	17.2	129.3	90.	81.	-40.
111212Z	12.8	146.1	80	12.8	146.0	75.	6.	-5.	12.6	139.2	85.	47.	-10.	14.7	132.9	95.	78.	-30.	18.1	128.2	105.	99.	-20.
111218Z	13.1	144.2	85	13.0	144.1	75.	8.	-10.	13.5	136.4	90.	61.	-10.	15.4	131.7	100.	83.	-30.	18.9	127.1	110.	120.	-15.
111300Z	12.7	142.3	90	13.0	142.1	85.	21.	-5.	14.1	134.2	95.	101.	-15.	17.6	129.0	100.	164.	-30.	21.5	127.4	95.	257.	-25.
111306Z	12.6	140.4	90	12.9	140.5	90.	19.	0.	13.5	134.9	95.	60.	-25.	15.3	131.0	100.	127.	-30.	18.4	127.8	95.	131.	-25.
111312Z	12.5	138.4	95	12.7	138.5	90.	13.	-5.	14.0	132.0	100.	38.	-25.	17.1	128.2	95.	43.	-30.	21.0	127.8	90.	261.	-25.
111318Z	12.6	136.9	100	12.8	137.0	95.	13.	-5.	14.5	131.2	105.	21.	-25.	17.6	127.8	95.	54.	-30.	21.6	128.4	85.	325.	-25.
111400Z	12.8	135.3	110	12.8	135.3	100.	0.	-10.	14.2	130.8	110.	71.	-20.	16.9	127.9	110.	84.	-10.	20.3	126.2	110.	198.	10.
111406Z	13.3	133.9	120	13.3	134.0	100.	6.	-20.	15.0	129.8	110.	75.	-20.	17.3	127.5	110.	104.	-10.	20.3	126.2	110.	205.	20.
111412Z	13.5	132.4	125	13.7	132.3	115.	13.	-10.	15.8	128.1	125.	45.	0.	18.4	126.1	120.	85.	5.	22.3	128.5	110.	379.	20.
111418Z	14.2	131.0	130	14.3	131.0	115.	6.	-15.	16.7	127.4	125.	17.	0.	19.3	126.2	120.	141.	10.	22.6	129.4	110.	424.	30.
111500Z	15.0	129.9	130	15.0	129.6	130.	17.	0.	17.9	126.5	140.	36.	20.	20.6	127.0	130.	244.	30.	24.9	132.8	115.	631.	35.
111506Z	15.9	128.9	130	15.8	128.8	120.	8.	-10.	18.9	126.4	125.	93.	5.	21.8	127.9	115.	333.	25.	26.0	135.2	100.	759.	30.
111512Z	16.5	127.8	125	16.6	127.9	115.	8.	-10.	19.7	126.3	105.	147.	-10.	22.9	129.5	95.	444.	5.	27.4	137.7	85.	900.	20.
111518Z	16.9	127.2	125	17.0	127.4	120.	13.	-5.	19.8	127.2	105.	205.	-5.	23.0	132.1	95.	573.	15.	27.7	140.7	80.	1040.	20.
111600Z	17.3	126.5	120	17.4	126.6	115.	8.	-5.	19.0	125.0	105.	96.	5.	22.6	128.6	95.	365.	15.	27.4	137.2	80.	865.	25.
111606Z	17.5	125.7	120	17.6	126.0	110.	18.	-10.	19.1	124.6	95.	94.	5.	22.5	128.4	85.	334.	15.	27.2	136.8	75.	855.	25.
1116122	17.7	124.8	115	17.5	124.9	90.	13.	-25.	19.4	122.3	75.	11.	-15.	22.5	125.7	60.	192.	-5.	26.5	134.2	50.	747.	0.
111618Z	17.9	124.2	110	17.9	124.2	90.	0.	-20.	19.9	122.3	75.	6.	-5.	23.0	127.1	60.	262.	0.	27.6	136.3	50.	889.	5.
111700Z	18.1	123.6	100	18.2	123.6	95.	6.	-5.	19.5	120.8	85.	110.	5.	21.1	119.3	75.	289.	20.	22.6	118.8	65.	626.	20.
111706Z	18.7	123.0	90	18.7	123.0	95.	0.	5.	20.1	120.8	85.	119.	15.	21.6	119.8	75.	348.	25.	23.3	119.8	60.	644.	20.
111712Z	19.4	122.5	90	19.5	122.8	105.	18.	15.	21.5	121.8	100.	115.	35.	23.7	122.7	90.	449.	40.	24.9	125.0	80.	612.	40.
111718Z	19.9	122.4	80	20.0	122.3	105.	8.	25.	22.0	121.7	95.	164.	35.	23.7	123.4	85.	483.	40.	24.8	125.7	75.	626.	45.
111800Z	20.2	122.6	80	20.2	122.6	95.	0.	15.	21.3	122.4	90.	149.	35.	23.0	123.3	80.	491.	35.	24.2	125.6	70.	620.	40.
111806Z	20.3	122.9	70	20.4	122.7	95.	13.	25.	21.7	122.9	85.	236.	35.	23.2	124.2	75.	507.	35.	24.3	126.4	65.	568.	35.
111812Z	20.2	123.3	65	20.5	123.6	90.	25.	25.	21.6	126.1	70.	289.	20.	22.6	129.8	65.	461.	25.	0.0	0.0	0.	-0.	0.
111818Z	20.0	123.7	60	20.5	123.5	85.	32.	25.	21.2	125.9	55.	306.	10.	22.3	129.5	50.	460.	20.	0.0	0.0	0.	-0.	0.
111900Z	19.4	124.1	55	19.5	124.0	65.	8.	10.	17.9	127.9	40.	147.	-5.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
111906Z	18.2	124.8	50	18.2	123.7	45.	63.	-5.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
111912Z	16.8	125.8	50	17.0	125.0	30.	47.	-20.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
111918Z	16.1	126.2	45	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
112000Z	15.6	127.0	45	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
112006Z	15.3	127.4	40	15.0	128.1	40.	44.	0.	15.1	130.1	55.	52.	25.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
112012Z	15.1	128.0	40	15.2	128.1	45.	8.	5.	15.5	130.2	55.	107.	30.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
112018Z	14.7	128.5	30	15.2	128.5	50.	30.	20.	15.5	130.3	60.	158.	35.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
112100Z	14.4	129.1	30	14.3	129.2	30.	8.	0.	15.4	131.1	40.	267.	15.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
112106Z	15.2	129.2	30	14.5	129.0	30.	44.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
112112Z	15.1	128.4	25	14.5	129.0	30.	50.	5.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
112118Z	14.1	128.0	25	14.4	129.2	30.	72.	5.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
112200Z	12.9	127.3	25	14.4	129.2	20.	143.	-5.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.

	ALL FORECASTS WRNG	24-HR	48-HR	72-HR	TYPHOONS WHILE OVER 35 KTS WRNG	24-HR	48-HR	72-HR
AVG FORECAST POSIT ERROR	20.	98.	226.	406.	15.	93.	220.	389.
AVG RIGHT ANGLE ERROR	9.	50.	141.	297.	9.	48.	136.	298.
AVG INTENSITY MAGNITUDE ERROR	8.	14.	18.	22.	8.	12.	18.	21.
AVG INTENSITY BIAS	-0.	3.	4.	7.	-1.	1.	3.	4.
NUMBER OF FORECASTS	52	46	41	39	46	42	40	36

DISTANCE TRAVELED BY TROPICAL CYCLONE IS 2892. NM

AVERAGE SPEED OF TROPICAL CYCLONE IS 9. KNOTS

TYPHOON BILL
FIX POSITIONS FOR CYCLONE NO. 28

SATELLITE FIXES

FIX NO.	TIME (Z)	FIX POSITION	ACCRY	DVORAK CODE	COMMENTS	SITE
1	072323	13.5N 154.5E	PCN 5	T1.5/1.5	INIT OBS	PGTW
2	080300	14.0N 154.2E	PCN 6			PGTW
* 3	080607	13.9N 154.7E	PCN 5			PGTW
4	080900	14.1N 154.6E	PCN 5			PGTW
5	081204	14.7N 154.2E	PCN 5		ULCC 14.1N 155.8E	PGTW
* 6	081600	14.1N 155.3E	PCN 6		ULCC FIX	PGTW
7	081800	14.6N 153.6E	PCN 6	T1.5/1.5	INIT OBS ULCC 14.0N 155.3E	PGTW
8	081959	14.2N 153.9E	PCN 5		ULCC 14.2N 155.1E	PGTW
9	082303	14.0N 154.1E	PCN 5	T3.0/3.0 /D1.5/24HRS		PGTW
10	090300	14.1N 153.6E	PCN 6			PGTW
11	090554	14.2N 153.7E	PCN 5			PGTW
12	090839	14.0N 153.9E	PCN 5			PGTW
13	091143	14.3N 154.0E	PCN 6			PGTW
14	091600	14.3N 154.3E	PCN 6	T3.0/3.0 /D1.5/22HRS	ULCC 14.9N 154.9E	PGTW
15	091839	14.2N 154.3E	PCN 5			PGTW
16	091937	14.3N 154.5E	PCN 6			PGTW
17	092133	14.4N 153.8E	PCN 5			PGTW
18	100024	14.0N 154.2E	PCN 3	T3.0/3.0+/S0.0/25HRS		PGTW
19	100300	14.1N 153.7E	PCN 6			PGTW
20	100542	14.2N 153.8E	PCN 3			PGTW
21	100817	14.3N 153.7E	PCN 5			PGTW
* 22	101200	15.5N 153.2E	PCN 6		ULCC FIX	PGTW
23	101600	14.7N 153.3E	PCN 6	T3.0/3.0+/S0.0/24HRS		PGTW
24	101800	14.2N 153.1E	PCN 6		ULCC FIX	PGTW
25	101916	14.2N 152.8E	PCN 6		ULCC FIX	PGTW
26	102109	14.3N 152.4E	PCN 5			PGTW
27	110004	14.2N 152.5E	PCN 3	T4.0/4.0 /D1.0/24HRS		PGTW
28	110300	14.6N 152.7E	PCN 2			PGTW
29	110529	14.7N 152.3E	PCN 2			PGTW
30	110756	14.2N 151.7E	PCN 4			PGTW
31	111244	14.3N 150.9E	PCN 3			PGTW
32	111600	14.0N 150.5E	PCN 6	T3.5/3.5 /D0.5/24HRS		PGTW
33	111814	13.8N 150.3E	PCN 6			PGTW
34	112036	13.8N 149.9E	PCN 6		ULCC 14.8N 150.5E	PGTW
35	112100	13.8N 150.1E	PCN 6			PGTW
36	112344	13.7N 149.2E	PCN 3	T3.5/4.0+/W0.5/24HRS		PGTW
37	120300	13.6N 148.5E	PCN 4			PGTW
38	120517	13.4N 147.7E	PCN 5			PGTW
39	120716	13.2N 146.7E	PCN 3			PGTW
40	121224	12.8N 145.6E	PCN 4			PGTW
41	121600	13.1N 144.8E	PCN 4	T4.5/4.5 /D1.0/24HRS		PGTW
42	121801	13.1N 144.0E	PCN 4			PGTW
43	122015	13.1N 143.5E	PCN 4			PGTW
44	130105	12.8N 141.8E	PCN 3	T4.5/4.5 /D1.0/25HRS		PGTW
45	130300	12.8N 141.3E	PCN 2			PGTW
46	130646	12.7N 140.3E	PCN 3			PGTW

47	130855	12.7N	139.4E	PCN 3			PGTW
48	131200	12.7N	138.5E	PCN 4			PGTW
49	131345	12.5N	138.1E	PCN 3			PGTW
50	131600	12.6N	137.4E	PCN 2	T5.0/5.0 /D0.5/24HRS		PGTW
51	131800	12.8N	137.0E	PCN 2		EYE FIX	PGTW
52	131931	12.7N	136.6E	PCN 1		EYE FIX	PGTW
53	132135	12.7N	136.0E	PCN 1		EYE FIX	PGTW
54	140000	12.9N	135.4E	PCN 2			PGTW
55	140044	12.9N	135.0E	PCN 2	T6.0/6.0 /D1.5/24HRS		PGTW
56	140300	12.9N	134.7E	PCN 2			PGTW
57	140600	13.2N	134.0E	PCN 2			PGTW
58	140634	13.5N	133.9E	PCN 2			PGTW
59	140634	13.4N	133.4E	PCN 1	T5.5/5.5	INIT OBS EYE DIA 18NM	RPMK
60	140900	13.3N	133.1E	PCN 2			PGTW
61	141015	13.4N	132.9E	PCN 2			PGTW
62	141200	13.7N	132.4E	PCN 2			PGTW
63	141325	13.6N	131.9E	PCN 2			PGTW
64	141600	14.0N	131.4E	PCN 2			PGTW
65	141800	14.3N	131.0E	PCN 2	T6 0/6.0 /D1.0/26HRS		PGTW
66	141918	14.6N	130.3E	PCN 2			PGTW
67	142100	14.8N	130.4E	PCN 2			PGTW
68	142254	14.9N	130.1E	PCN 1			PGTW
69	150000	15.0N	129.9E	PCN 2			PGTW
70	150300	15.4N	129.5E	PCN 4	T5.0/6.0 /W1.0/25HRS		PGTW
71	150600	15.9N	129.0E	PCN 2			PGTW
72	150621	16.1N	128.7E	PCN 2			PGTW
73	150900	16.4N	128.5E	PCN 4			PGTW
74	150951	16.5N	128.3E	PCN 4			PGTW
75	151200	16.5N	127.7E	PCN 4			PGTW
76	151305	16.5N	127.6E	PCN 2			PGTW
77	151600	16.8N	127.6E	PCN 2	T6.5/6.5-/D0.5/22HRS		PGTW
78	151800	17.0N	127.3E	PCN 2			PGTW
79	151906	17.1N	127.0E	PCN 2			PGTW
80	152100	17.2N	127.0E	PCN 2			PGTW
81	152230	17.3N	126.7E	PCN 1			PGTW
82	160000	17.5N	126.5E	PCN 4			PGTW
83	160145	17.3N	126.4E	PCN 3			PGTW
84	160145	17.3N	126.5E	PCN 3	T6.0/6.0	INIT OBS	RPMK
85	160300	17.5N	126.1E	PCN 4	T4.5/5.0 /W0.5/24HRS		PGTW
86	160600	17.5N	125.8E	PCN 4			PGTW
87	160750	17.3N	125.9E	PCN 1			RPMK
88	160933	17.4N	125.3E	PCN 6			PGTW
89	161108	17.4N	125.5E	PCN 5			RPMK
90	161108	17.7N	125.4E	PCN 3			RODN
91	161426	17.7N	125.0E	PCN 5			PGTW
92	161800	18.0N	124.3E	PCN 6	T5.0/6.5 /W1.5/26HRS		PGTW
93	162035	18.0N	124.0E	PCN 1			RPMK
94	162100	17.9N	123.8E	PCN 6			PGTW
95	162212	18.2N	123.9E	PCN 1		EYE FIX	RODN
96	162346	18.2N	123.6E	PCN 1	T5.0/5.0	INIT OBS EYE FIX	RODN
97	162347	18.0N	123.6E	PCN 3	T5.0/6.0 /W1.0/22HRS		RPMK
98	170125	18.1N	123.3E	PCN 1			RPMK
99	170125	18.2N	123.5E	PCN 1		EYE FIX	PGTW
100	170300	18.4N	123.3E	PCN 2		EYE FIX	PGTW
101	170600	18.8N	123.1E	PCN 2			PGTW
102	170738	18.9N	123.0E	PCN 1		EYE FIX	RPMK
103	170738	18.9N	123.0E	PCN 1	T6.0/6.0-/D1.5/28HRS	EYE DIA 12NM	PGTW
104	171044	19.3N	122.8E	PCN 1		EYE DIA 18NM	PGTW
105	171052	19.4N	122.6E	PCN 1		EYE FIX	RODN
106	171200	19.4N	122.8E	PCN 2		EYE FIX	PGTW
107	171406	19.8N	122.5E	PCN 3			PGTW
108	171800	20.0N	122.2E	PCN 4	T4.5/5.5 /W0.5/24HRS		PGTW
109	172023	20.0N	122.7E	PCN 1		EYE FIX	RPMK
110	172100	20.0N	122.7E	PCN 2		EYE DIA 12NM	PGTW
111	172322	20.2N	122.7E	PCN 1	T4.5/5.0 /W0.5/24HRS		RODN
112	180000	20.2N	122.7E	PCN 4			PGTW
113	180105	20.1N	122.6E	PCN 2	T5.0/5.0 /S0.0/24HRS		RPMK
114	180300	20.3N	122.7E	PCN 4	T4.0/5.0+/W2.0/20HRS		PGTW
115	180600	20.3N	122.9E	PCN 4		ULCC FIX	PGTW
116	180725	20.4N	123.2E	PCN 3			RPMK
117	180900	20.5N	123.2E	PCN 6			PGTW
118	181020	20.3N	123.1E	PCN 3			RPMK
119	181020	20.2N	123.2E	PCN 3			RODN
120	181031	20.3N	123.1E	PCN 4		ULCC FIX	RSKO
121	181200	20.3N	123.5E	PCN 6			PGTW
122	181346	20.2N	123.6E	PCN 5			RPMK
123	181600	20.2N	123.3E	PCN 6			PGTW
124	181800	20.1N	123.0E	PCN 6	T4.0/4.5-/W0.5/22HRS		PGTW
125	182010	20.5N	123.5E	PCN 5			RPMK
126	182100	20.2N	123.6E	PCN 6		ULCC FIX	PGTW
127	182130	20.1N	123.7E	PCN 6			RPMK
128	182130	19.8N	123.7E	PCN 6			PGTW
*129	182258	19.8N	124.9E	PCN 3		EXP LLCC	RPMK
*130	182258	19.6N	125.0E	PCN 6		ULCC 20.2N 123.5E	PGTW
131	182258	20.4N	123.6E	PCN 5			RSKO
132	190045	19.3N	124.3E	PCN 6			PGTW
133	190045	20.3N	124.5E	PCN 5	T3.5/3.5	INIT OBS ULCC FIX	RSKO
134	190713	17.8N	123.1E	PCN 5	T2.0/3.0 /W2.0/28HRS		PGTW
135	191200	16.7N	125.2E	PCN 6			PGTW
*136	191600	15.9N	124.5E	PCN 6			PGTW
137	200000	16.2N	127.0E	PCN 6		ULCC FIX	PGTW
138	200205	16.2N	127.5E	PCN 5		ULCC FIX	RODN
139	200300	16.3N	127.4E	PCN 6	T2.0/2.0+/S0.0/20HRS	ULCC FIX	PGTW
*140	200600	16.3N	127.8E	PCN 6		ULCC FIX	PGTW
141	200700	15.7N	127.9E	PCN 6			PGTW
142	201200	15.8N	127.2E	PCN 6			PGTW
143	201305	15.9N	127.5E	PCN 6			PGTW
144	201600	15.4N	128.3E	PCN 6	T1.5/1.5	INIT OBS	PGTW
145	201800	15.4N	128.5E	PCN 6			PGTW
146	201945	15.4N	128.5E	PCN 5			PGTW
147	202048	15.6N	128.4E	PCN 5			PGTW
148	202210	14.6N	129.1E	PCN 5			PGTW
149	210000	15.2N	129.3E	PCN 6		ULCC FIX	PGTW
*150	210146	14.5N	129.2E	PCN 5		ULCC FIX	PGTW
151	210300	15.2N	129.4E	PCN 6			PGTW
152	210648	14.6N	128.9E	PCN 5	T2.0/2.0-/S0.0/27HRS		PGTW
153	210928	15.1N	128.4E	PCN 5			PGTW
154	211048	15.4N	128.0E	PCN 5			PGTW
155	211200	15.2N	128.1E	PCN 6			PGTW
156	211426	14.9N	128.6E	PCN 5			PGTW
157	211600	14.9N	128.5E	PCN 6			PGTW
*158	211800	14.8N	129.1E	PCN 6	T1.5/1.5-/S0.0/26HRS		PGTW
159	211932	13.9N	127.9E	PCN 5			PGTW
160	212208	13.4N	127.3E	PCN 5			PGTW
161	212326	14.8N	129.8E	PCN 5	T1.0/1.0	INIT OBS	RODN
162	212326	14.8N	129.8E	PCN 5	T1.0/1.0	INIT OBS	RPMK
163	220125	12.8N	127.4E	PCN 5			PGTW

AIRCRAFT FIXES

FIX NO	TIME (Z)	FIX POSITION	FLT LVL	700MB HGT	OBS MSLP	MAX-SFC-WND VEL/BRG/RNG	MAX-FLT-LVL-WND DIR/VEL/BRG/RNG	ACCRY NAV/MET	EYE SHAPE	EYE DIAM/ORIENTATION	EYE TEMP (C) OUT/ IN/ DP/SST	MSN NO.
1	080735	14.4N 153.6E	850MB			20 240 90	280 30 220 60	8 10			+21 +20 +16	1
2	082142	13.9N 153.6E	1500FT		1000	40 320 40	050 40 320 49	12 2			+24 +25 +23	2
3	082348	13.8N 153.7E	1500FT		999	45 350 40	060 48 350 40	12 2			+24 +25 +23	2
4	090555	14.2N 153.9E	700MB	3070		40 260 45	220 31 140 103	8 10				4
5	090826	14.2N 153.8E	700MB	3071	998		150 37 040 65	12 10			+13 +15 + 9	4
6	092102	14.3N 153.9E	700MB	3037	990	50 260 30	340 56 260 33	8 4			+21 +21	5
7	092332	14.3N 153.8E	1500FT		990	50 360 30	120 50 360 14	8 1			+26 +27 +26	5
8	100601	14.3N 153.7E	700MB	3004		65 240 20	300 55 230 17	10 1			+18 +23 +10	7
9	100835	14.3N 153.7E	700MB	3038			180 48 060 30	10 2			+19 +22 + 7	7
10	102042	14.3N 153.1E	700MB	3046		50 270 20	260 39 180 20	15 2			+13 +17 + 7	8
11	102323	14.6N 152.9E	700MB	2964	986	100 350 40	080 57 350 10	10 2	CIRCULAR	15	+12 +17 + 9	8
12	110832	14.3N 151.8E	700MB	3019	993		190 33 130 140	4 3			+17 +19 + 7	10
13	111036	14.2N 151.6E	700MB	3021	992		080 60 010 60	10 5			+15 +19 + 6	10
14	112050	13.4N 149.9E	700MB	3019		70 270 4	080 64 320 58	10 2			+12 +19 +10	11
15	112331	13.4N 149.1E	700MB	3009	991	70 030 30	140 47 030 120	6 2	CIRCULAR	17	+13 +17 + 9	11
16	121213	12.7N 146.0E	700MB	2923	981		350 65 320 150	5 1	ELLIPTICAL	25 8 070	+11 +14 + 8	13
17	121641	13.0N 144.6E	700MB	2859	973		080 78 330 45	7 2	CIRCULAR	10	+16 +20 + 2	14
18	122300	12.8N 142.5E	700MB	2841	969	100 310 10	090 76 330 90	12 1	CONCENTRIC	4 8	+14 +17 +11	15
19	130741	12.7N 139.7E	700MB	2817	967	80 280 10	030 69 280 30	6 2	CONCENTRIC	10 20	+12 +15 +13	15
20	131019	12.5N 138.9E	700MB	2792	966		090 90 360 20	6 2	CIRCULAR	15	+11 +15 +12	16

21	132038	12.6N 136.2E	700MB	2566					340	90	240	7	10	1	ELLIPTICAL	30	23	180	+12	+18	+12	18
22	132312	12.8N 135.5E	700MB	2511	932	100	220	10	220	110	130	17	10	1	ELLIPTICAL	23	18	130	+12	+21	+10	18
23	140831	13.4N 133.2E	700MB	2336	913	100	270	10	010	105	270	14	7	2	CIRCULAR	10			+18	+26		19
24	141103	13.6N 132.5E	700MB	2334	912				190	133	110	14	7	2	CIRCULAR	15			+17	+27		19
25	142030	14.5N 130.3E	700MB	2325					030	105	290	17	5	2	CONCENTRIC	8	13		+17	+25	+ 5	21
26	142234	14.8N 130.0E	700MB	2288	909	120	120	16	190	126	110	13	5	2	CIRCULAR	20			+14	+24	+13	21
27	150838	16.2N 128.3E	700MB	2540	937	110	180	15	240	98	180	13	13	2	CIRCULAR	25			+17	+19	+15	23
28	151110	16.5N 127.9E	700MB	2554	939				150	127	020	12	10	2	CIRCULAR	30			+17	+20	+15	23
29	152030	17.1N 127.0E	700MB	2523					060	114	330	15	5	2	ELLIPTICAL	30	20	120	+12	+22	+12	24
30	152309	17.2N 126.6E	700MB	2388	941	125	140	20	170	125	040	16	3	3	ELLIPTICAL	30	20	120	+14	+23	+11	24
31	160835	17.4N 125.4E	700MB	2641		100	220	27	090	110	350	20	4	2	CIRCULAR	25			+12	+19	+13	25
32	161137	17.5N 124.9E	700MB	2669	951				220	85	140	18	4	8	CIRCULAR	20			+13	+23	+ 8	25
33	162030	17.9N 124.0E	700MB	2977					090	100	030	21	15	3	CIRCULAR	23			15	22	12	26
34	162306	18.0N 123.5E	700MB	2670	951	110	120	15	200	104	270	15	15	3	CIRCULAR	21			+17	+20	+13	26
35	170543	18.8N 123.0E	700MB	2536	936	90	160	10	240	90	160	4	9	2	ELLIPTICAL	20	10	150	+11	+20	+10	27
36	170828	19.0N 123.0E	700MB	2548	936	90	270	10	150	107	090	10	8	2	CIRCULAR	19			+12	+16	+12	27
37	172100	20.0N 122.8E	700MB	2661					040	92	290	16	4	1	CIRCULAR	8			+13	+17	+13	28
38	172343	20.2N 122.6E	700MB	2676	953	80	230	20	190	99	130	25	4	8	CONCENTRIC	15	40		+14	+21	+ 9	28
39	180842	20.3N 123.2E	700MB	2766	962	90	230	10	130	100	020	16	15	2	CIRCULAR	18			+14	+24	+11	29
40	182045	20.0N 123.5E	700MB	2963					320	64	280	15	10	5	ELLIPTICAL	16	10	240	+12	+19	+ 6	30
41	182326	19.4N 123.7E	700MB	3014	987	50	010	8	290	49	220	27	12	3					+11	+20	+10	30
42	191130	16.9N 125.6E	700MB	3059	997				080	28	330	55	10	20					+16	+18	+ 8	31
43	192315	15.8N 127.1E	1500FT		1000	55	200	30	010	67	200	30	4	4					+27	+27	+24	32
44	200205	15.3N 127.3E	1500FT		999	55	100	14	190	44	120	40	3	2					+28	+27	+24	32
45	202117	15.5N 128.8E	700MB	3100		30	270	90	320	19	270	15	12	5					+12	+14	+16	33
46	202325	14.4N 129.1E	1500FT		1002	30	270	10	330	30	210	38	12	1					+28	+30	+23	33

RADAR FIXES

FIX NO.	TIME (Z)	FIX POSITION	RADAR	ACCRY	EYE SHAPE	EYE DIAM	RADOB-CODE ASWAR TDDFF	COMMENTS	RADAR POSITION	SITE WMO NO
1	120635	13.3N 147.2E	LAND	FAIR	CIRCULAR	12		WALL CLD OPN E	13.6N 144.9E	91218
2	120735	13.1N 147.1E	LAND	POOR	CIRCULAR	12		MOV 0810 WALL CLD OPN E	13.6N 144.9E	91218
3	120835	13.1N 146.8E	LAND	GOOD	CIRCULAR	14		MOV 0820 WALL CLD OPN NE	13.6N 144.9E	91218
4	121035	13.0N 146.2E	LAND	GOOD	ELLIPTICAL			MOV 0818 MAJOR AXIS 12/6	13.6N 144.9E	91218
5	121135	12.8N 146.0E	LAND	GOOD	CIRCULAR	10		MOV 0512 WALL CLD OPN NNW	13.6N 144.9E	91218
6	121235	12.9N 145.8E	LAND	GOOD	CIRCULAR	11		MOV 1210	13.6N 144.9E	91218
7	121335	13.0N 145.6E	LAND	GOOD	CIRCULAR	9		MOV 1114 WALL CLD OPN SSN	13.6N 144.9E	91218
8	121445	13.0N 145.5E	LAND	GOOD	CIRCULAR	9		MOV 1015	13.6N 144.9E	91218
9	121535	13.1N 145.0E	LAND	GOOD	CIRCULAR	9		MOV 1017	13.6N 144.9E	91218
10	121635	13.0N 144.8E	LAND	GOOD		9		MOV 0710	13.6N 144.9E	91218
11	121735	13.0N 144.2E	LAND						13.6N 144.9E	91218
12	121835	13.0N 143.8E	LAND	GOOD		9		WALL CLD OPN SW	13.6N 144.9E	91218
13	121935	13.0N 143.6E	LAND	GOOD		10			13.6N 144.9E	91218
14	122135	13.0N 143.3E	LAND	POOR					13.6N 144.9E	91218
* 15	130035	11.8N 141.5E	LAND	POOR					13.6N 144.9E	91218
16	162100	17.7N 124.0E	LAND				4//// /////	SPIR OVRLY 015 DEG	16.3N 120.6E	98321
17	170000	18.1N 123.7E	LAND				///// 43308		16.3N 120.6E	98321
18	170300	18.3N 123.5E	LAND				4//// 40000		16.3N 120.6E	98321
19	170500	18.7N 123.4E	LAND				4//// 53610		16.3N 120.6E	98321
20	170700	19.2N 123.0E	LAND				///// /////		18.4N 121.6E	98231
21	170700	19.1N 123.2E	LAND				40000 43512	SPIR OVRLY 015 DEG	16.3N 120.6E	98321
22	170800	19.2N 122.9E	LAND				11812 52902	EYE 60 PCT ELIP OPN NE	18.4N 121.6E	98231
23	170800	19.3N 123.0E	LAND				4//// 43508	SPIR OVRLY 015 DEG	16.3N 120.6E	98321
24	171100	19.5N 122.8E	LAND				11782 /////		18.4N 121.6E	98231
25	171200	19.6N 122.7E	LAND				///// 43208		18.4N 121.6E	98231
26	171600	19.8N 122.5E	LAND				11742 43605	EYE 60 PCT CIR OPN NE-SE-S	18.4N 121.6E	98231
27	171700	19.8N 122.5E	LAND				10672 43460		18.4N 121.6E	98231
28	171900	19.9N 122.7E	LAND				10791 40703	EYE 70 PCT CIR OPN SW	18.4N 121.6E	98231
29	172000	20.0N 122.7E	LAND				10681 40403	EYE 75 PCT CIR OPN SW	18.4N 121.6E	98231
30	172100	20.2N 122.8E	LAND				11861 40210	EYE 60 PCT ELIP OPN SE	18.4N 121.6E	98231
31	180700	20.5N 123.2E	LAND				11850 52704	EYE 50 PCT ELIP	18.4N 121.6E	98231
32	180800	20.5N 123.2E	LAND				///// /////		18.4N 121.6E	98231
33	180900	20.5N 123.4E	LAND				11741 50904		18.4N 121.6E	98231
34	181100	20.5N 123.6E	LAND				45/// 60908		18.4N 121.6E	98231
35	181200	20.5N 123.6E	LAND				25//1 50000		18.4N 121.6E	98231
36	181300	20.4N 123.7E	LAND				45/// 51204		18.4N 121.6E	98231
37	181300	20.5N 123.7E	LAND				45/// 51204		16.3N 120.6E	98321
38	181400	20.5N 123.7E	LAND				55//0 50201		16.3N 120.6E	98321
39	181500	20.5N 123.7E	LAND				55//0 50000		16.3N 120.6E	98321
* 40	190600	18.7N 123.4E	LAND				5//// /////		18.4N 121.6E	98231
* 41	190700	18.7N 123.3E	LAND				5//// 52504		18.4N 121.6E	98231
* 42	190800	18.7N 123.4E	LAND				5//// 50902		18.4N 121.6E	98231
* 43	190900	18.7N 123.3E	LAND				5//// 52502	SPIR OVRLY 10 DEG	18.4N 121.6E	98231
* 44	191100	18.5N 123.3E	LAND				5//// 62010		18.4N 121.6E	98231

NOTICE - THE ASTERISKS (*) INDICATE FIXES UNREPRESENTATIVE AND NOT USED FOR BEST TRACK PURPOSES.

TYPHOON CLARA
BEST TRACK DATA

	BEST TRACK			WARNING			ERRORS		24 HOUR FORECAST			ERRORS		48 HOUR FORECAST			ERRORS		72 HOUR FORECAST			ERRORS	
MO/DA/HR	POSIT		WIND	POSIT		WIND	DST	WIND	POSIT		WIND	DST	WIND	POSIT		WIND	DST	WIND	POSIT		WIND	DST	WIND
111400Z	5.4	156.4	20	0.0	0.0	0	-0	0	0.0	0.0	0	-0	0	0.0	0.0	0	-0	0	0.0	0.0	0	-0	0
111406Z	5.7	155.4	25	5.6	155.5	25	8	0	6.0	152.3	35	176	0	6.7	148.5	55	283	-10	7.5	143.5	75	360	-10
111412Z	6.1	154.4	25	6.1	154.0	30	24	5	7.2	149.3	50	78	5	8.0	144.6	60	152	-10	8.9	139.9	75	227	-20
111418Z	6.7	153.1	25	6.9	152.6	40	32	15	8.7	148.3	55	68	0	10.0	143.8	65	148	-10	11.2	139.1	80	200	-25
111500Z	7.2	151.7	30	7.3	152.0	35	19	5	9.4	147.8	55	108	-5	11.5	143.3	65	209	-15	13.5	138.7	80	241	-30
111506Z	7.7	149.9	35	7.8	150.9	35	60	0	10.2	146.5	55	122	-10	11.9	141.8	65	203	-20	12.7	136.8	80	178	-30
111512Z	7.9	148.2	45	8.6	148.9	35	59	-10	11.0	143.4	60	80	-10	12.5	137.4	75	63	-20	15.1	131.8	90	100	-10
111518Z	8.4	147.2	55	9.1	147.3	40	42	-15	11.6	142.0	65	94	-10	13.9	136.3	80	118	-25	16.7	130.9	95	146	5
111600Z	9.1	146.0	60	9.2	145.9	60	8	0	11.3	140.3	75	53	-5	14.1	134.9	95	97	-15	16.8	130.3	105	130	25
111606Z	9.4	144.6	65	9.5	144.6	60	6	-5	11.1	139.4	75	54	-10	13.4	134.6	95	48	-15	16.4	130.1	105	143	15
111612Z	9.8	142.8	70	9.9	142.9	60	8	-10	11.9	136.8	75	30	-20	14.7	132.3	95	63	-5	18.1	128.2	105	247	5
111618Z	10.2	141.3	75	10.4	141.1	60	17	-15	12.9	135.2	75	64	-30	15.8	130.8	95	120	5	19.5	127.0	105	322	-5
111700Z	10.5	139.9	80	10.5	140.3	70	24	-10	12.6	135.6	90	53	-20	15.9	131.4	100	58	20	20.3	129.4	110	221	5
111706Z	10.9	138.5	85	11.0	138.6	75	8	-10	13.7	133.4	95	38	-15	17.5	130.4	105	115	15	21.9	129.2	110	289	10
111712Z	11.5	137.1	95	11.5	137.3	85	12	-10	15.0	132.6	105	67	5	19.9	131.3	115	103	15	23.9	133.2	110	157	20
111718Z	12.0	135.8	105	12.4	135.8	90	24	-15	16.3	132.2	110	83	20	20.4	131.3	120	89	10	24.3	133.1	110	279	35
111800Z	12.5	134.7	110	12.5	134.7	110	0	0	16.2	130.9	130	87	50	20.1	130.1	130	185	25	23.7	133.9	120	376	45
111806Z	13.2	133.8	110	13.3	133.5	115	19	5	17.2	130.4	130	115	40	21.2	130.8	130	206	30	24.2	134.5	115	483	45
111812Z	14.0	133.1	100	13.9	133.1	115	6	15	17.5	131.3	130	95	30	20.8	131.6	130	290	40	23.4	133.9	115	677	55
111818Z	15.0	132.7	90	15.0	132.7	120	0	30	18.8	132.0	130	67	20	21.8	133.0	120	335	45	0.0	0.0	0	-0	0
111900Z	16.0	132.4	80	15.9	132.4	95	6	15	19.9	132.2	85	82	-20	22.8	133.7	80	408	5	0.0	0.0	0	-0	0
111906Z	17.3	132.4	90	17.3	132.3	85	6	-5	22.1	133.1	70	73	-30	25.7	135.0	65	434	-5	0.0	0.0	0	-0	0
111912Z	18.6	132.5	100	18.6	132.4	95	6	-5	24.8	134.6	90	114	0	30.6	140.7	80	336	20	0.0	0.0	0	-0	0
111918Z	19.7	132.7	110	19.9	132.7	100	12	-10	25.8	135.3	90	171	15	0.0	0.0	0	-0	0	0.0	0.0	0	-0	0
112000Z	20.8	133.3	105	20.8	133.1	105	11	0	25.6	135.8	95	249	20	0.0	0.0	0	-0	0	0.0	0.0	0	-0	0
112006Z	22.0	134.4	100	22.1	134.6	100	13	0	27.1	142.3	85	48	15	0.0	0.0	0	-0	0	0.0	0.0	0	-0	0
112012Z	23.4	136.0	90	23.6	136.0	95	12	5	29.7	144.7	70	165	10	0.0	0.0	0	-0	0	0.0	0.0	0	-0	0
112018Z	24.7	138.2	75	25.0	137.7	80	33	5	0.0	0.0	0	-0	0	0.0	0.0	0	-0	0	0.0	0.0	0	-0	0
112100Z	25.8	140.4	75	26.0	140.5	80	13	5	0.0	0.0	0	-0	0	0.0	0.0	0	-0	0	0.0	0.0	0	-0	0
112106Z	26.6	143.0	70	27.2	143.9	70	60	0	0.0	0.0	0	-0	0	0.0	0.0	0	-0	0	0.0	0.0	0	-0	0
112112Z	27.1	145.7	60	27.2	146.9	60	64	0	0.0	0.0	0	-0	0	0.0	0.0	0	-0	0	0.0	0.0	0	-0	0

	ALL FORECASTS				TYPHOONS WHILE OVER 35 KTS			
	WRNG	24-HR	48-HR	72-HR	WRNG	24-HR	48-HR	72-HR
AVG FORECAST POSIT ERROR	20	94	185	265	20	94	185	265
AVG RIGHT ANGLE ERROR	13	61	93	131	14	61	93	131
AVG INTENSITY MAGNITUDE ERROR	8	16	17	22	8	16	17	22
AVG INTENSITY BIAS	-1	2	4	8	-2	2	4	8
NUMBER OF FORECASTS	30	26	22	18	26	26	22	18

DISTANCE TRAVELED BY TROPICAL CYCLONE IS 2709 NM

AVERAGE SPEED OF TROPICAL CYCLONE IS 15. KNOTS

TYPHOON CLARA
FIX POSITIONS FOR CYCLONE NO. 29

SATELLITE FIXES

	FIX NO.	TIME (Z)	FIX POSITION	ACCRY	DVORAK CODE	COMMENTS	SITE
*	1	130600	4.7N 157.1E	PCN 6	T0.0/0.0	INIT OBS	PGTW
*	2	131200	6.0N 156.9E	PCN 6			PGTW
*	3	131600	5.8N 156.2E	PCN 6	T1.5/1.5	INIT OBS	PGTW
*	4	131800	6.0N 155.7E	PCN 6			PGTW
*	5	131954	5.7N 155.3E	PCN 6			PGTW
*	6	132303	5.4N 155.0E	PCN 6			PGTW
	7	140452	5.5N 155.7E	PCN 6			PGTW
	8	140600	5.4N 155.7E	PCN 6	T2.0/2.0 /D0.5/10HRS		PGTW
	9	140834	6.0N 155.0E	PCN 6		ULCC FIX	PGTW
*	10	141144	7.2N 153.3E	PCN 6			PGTW
*	11	141600	8.5N 152.1E	PCN 6	T3.5/3.5	INIT OBS	PGTW
*	12	141736	7.7N 152.3E	PCN 6			PGTW
*	13	141933	8.4N 151.1E	PCN 6			PGTW
*	14	142113	7.9N 151.4E	PCN 5			PGTW
*	15	150000	8.2N 150.9E	PCN 6		ULCC FIX	PGTW
	16	150024	7.6N 150.5E	PCN 6		ULCC FIX	PGTW
	17	150300	7.9N 150.1E	PCN 6	T3.0/3.0 /D1.0/21HRS	ULCC FIX	PGTW
	18	150600	7.8N 149.7E	PCN 6			PGTW
	19	150621	7.9N 149.6E	PCN 6		ULCC FIX	PGTW
	20	150812	7.8N 149.1E	PCN 6		ULCC FIX	PGTW
	21	150951	8.0N 149.1E	PCN 6		ULCC FIX	PGTW
	22	151200	8.3N 147.7E	PCN 6			PGTW
	23	151305	7.7N 147.6E	PCN 6			PGTW
	24	151600	8.5N 147.4E	PCN 6			PGTW
	25	151800	8.9N 147.0E	PCN 6	T3.0/3.5 /W0.5/26HRS		PGTW
	26	151906	9.1N 146.9E	PCN 6			PGTW
	27	152053	8.9N 146.1E	PCN 6			PGTW
	28	160004	9.1N 145.3E	PCN 5			PGTW
	29	160300	9.3N 145.4E	PCN 4	T3.5/3.5 /D0.5/24HRS		PGTW
	30	160609	9.6N 144.7E	PCN 3			PGTW
	31	160933	9.6N 143.5E	PCN 6			PGTW
	32	161244	9.8N 142.5E	PCN 6			PGTW
	33	161853	10.4N 140.9E	PCN 6	T3.5/3.5 /D0.5/24HRS		PGTW
	34	162031	10.6N 140.3E	PCN 6			PGTW
	35	162205	10.1N 140.5E	PCN 5			PGTW
	36	170125	10.5N 140.0E	PCN 6			PGTW
	37	170300	10.6N 139.6E	PCN 6			PGTW
	38	170556	11.0N 138.3E	PCN 5	T4.5/4.5 /D1.0/27HRS		PGTW
	39	170556	11.0N 138.6E	PCN 6	T4.0/4.0	INIT OBS	RODN
	40	170911	11.2N 137.9E	PCN 6			PGTW
	41	171200	11.8N 137.0E	PCN 6			PGTW
	42	171800	12.6N 135.8E	PCN 6	T5.0/5.0 /D1.5/24HRS		PGTW
	43	172100	12.5N 135.1E	PCN 6			PGTW
	44	180000	12.3N 134.4E	PCN 4			PGTW
	45	180105	12.6N 134.6E	PCN 2	T5.0/5.0	INIT OBS	RPMK
	46	180300	12.8N 134.1E	PCN 2	T5.5/5.5 /D1.0/20HRS		PGTW
	47	180600	13.4N 133.7E	PCN 4			PGTW
	48	180725	13.0N 133.6E	PCN 3			RPMK
	49	181020	14.1N 133.2E	PCN 3			RPMK
	50	181020	13.5N 133.2E	PCN 5			RODN
	51	181200	14.2N 133.1E	PCN 6		ULCC FIX	PGTW
	52	181346	14.5N 132.9E	PCN 5			RPMK
	53	181600	14.6N 133.1E	PCN 6	T5 5.5.5 /D0.5/22HRS		PGTW
	54	181800	15.3N 132.9E	PCN 6			PGTW
	55	182010	15.0N 132.3E	PCN 4			RPMK
	56	182100	15.8N 132.8E	PCN 6			PGTW
	57	182130	15.5N 132.5E	PCN 4		ULCC FIX	PGTW
	58	182130	15.2N 132.3E	PCN 4			RPMK
	59	182258	15.8N 132.3E	PCN 4			PGTW
	60	182258	15.3N 132.6E	PCN 4			RPMK
	61	190045	16.3N 132.1E	PCN 1			PGTW
	62	190045	15.7N 132.2E	PCN 2	T6.0/6.0	INIT OBS	RSKO
	63	190300	16.8N 132.2E	PCN 2	T5.0/5.0 /W0.5/24HRS		PGTW
	64	190713	17.6N 132.5E	PCN 3			PGTW
	65	190900	18.1N 132.1E	PCN 2			PGTW
	66	191010	17.8N 132.2E	PCN 2			PGTW
	67	191200	18.7N 132.3E	PCN 2			PGTW
	68	191325	19.2N 132.5E	PCN 1			PGTW
	69	191600	19.5N 132.6E	PCN 2	T6.0/6.0-/D0.5/24HRS		PGTW

	70	191800	19.9N 132.7E	PCN 2			PGTW
	71	192100	20.2N 132.9E	PCN 2			PGTW
	72	192109	20.3N 132.9E	PCN 2			PGTW
	73	192234	20.4N 133.1E	PCN 2			PGTW
	74	200024	20.8N 133.3E	PCN 1			PGTW
	75	200300	21.4N 133.8E	PCN 2	T5.0/5.0-/S0.0/24HRS		PGTW
	76	200600	22.1N 134.6E	PCN 2		EYE FIX	PGTW
	77	200700	22.3N 135.0E	PCN 1		EYE FIX	PGTW
	78	200931	23.1N 135.5E	PCN 1		EYE FIX	PGTW
	79	201200	23.4N 136.2E	PCN 4			PGTW
	80	201305	23.7N 136.6E	PCN 3			PGTW
	81	201600	24.5N 137.2E	PCN 6	T3.5/4.5 /W2.5/24HRS		PGTW
	82	201800	24.9N 137.7E	PCN 6			PGTW
	83	201945	25.1N 138.9E	PCN 5			PGTW
	84	202048	25.4N 139.7E	PCN 5			PGTW
	85	202210	25.6N 140.1E	PCN 5			PGTW
	86	210004	26.1N 140.6E	PCN 5			PGTW
*	87	210300	26.8N 143.0E	PCN 6	T3.5/4.0 /W1.5/21HRS		PGTW
*	88	210600	25.2N 143.2E	PCN 6			PGTW
	89	211245	27.3N 146.0E	PCN 5			PGTW
	90	211800	27.8N 148.0E	PCN 6			PGTW
	91	212027	27.9N 149.5E	PCN 5		EXP LLCC	PGTW
	92	220000	27.1N 150.7E	PCN 6			PGTW
*	93	220300	27.0N 151.5E	PCN 6			PGTW

AIRCRAFT FIXES

FIX NO.	TIME (Z)	FIX POSITION	FLT LVL	700MB HGT	OBS MSLP	MAX-SFC-WND VEL/BRG/RNG	MAX-FLT-LVL-WND DIR/VEL/BRG/RNG	ACCRY NAV/MET	EYE SHAPE	EYE ORIEN- DIAM/TATION	EYE TEMP (C) OUT/ IN/ DP/SST	MSN NO.
1	140454	5.6N 155.6E	1500FT		1001	15 300 40	300 20 300 40	10 5			+24 +25 +23 27	1
2	142053	6.8N 152.4E	850MB			25 090 25	020 23 340 30	10 20			+18 +19 +18	2
3	142244	7.1N 152.3E	1500FT		1003	30 040 15	150 27 040 30	10 5			+24 +23 +23	2
4	150829	8.2N 149.7E	1500FT		996	35 090 25	200 40 090 25	12 10			+24 +26 26	3
5	151043	7.5N 148.6E	700MB	3087			020 30 280 50	15 15				3
6	151943	8.8N 146.9E	850MB			50 130 30	210 36 130 30	8 4			+19 +23 +18	4
7	152316	9.1N 146.1E	700MB	3010	988	70 350 30	170 58 090 20	8 1			+14 +16 + 9	4
8	160532	9.4N 144.7E	1500FT		982	55 360 20	070 49 360 31	10 3	CIRCULAR	40	+26 +27 +25 26	5
9	160854	9.7N 143.8E	700MB	2993			050 54 310 30	10 5			+12 +15 +13	5
10	161031	9.7N 143.1E	700MB	3000			090 61 350 30	10 5	CIRCULAR	40	+14 +16 +11	5
11	162036	10.2N 141.0E	700MB	2865		65 350 15	070 70 350 15	8 5	ELLIPTICAL	30 20 050	+16 +17 +15	6
12	162321	10.4N 140.5E	700MB	2880	974	80 050 10	150 84 050 10	8 3	ELLIPTICAL	40 30 070	+13 +17 +14	6
13	170541	10.9N 138.7E	700MB	2822	967	90 090 15	060 60 340 55	20 3	CIRCULAR	27	+15 +18 +10	[illegible]
14	170800	11.0N 138.1E	700MB	2818	965	110 050 30	180 100 050 30	20 5	CIRCULAR	20	+18 +21 + 9	[illegible]
15	172041	12.2N 135.2E	700MB	2703		55 300 60	110 126 050 10	10 5	CIRCULAR	20	+13 +23 +14	9
16	172312	12.3N 134.8E	700MB	2740	960	120 300 10	350 88 300 40	10 2	ELLIPTICAL	20 15 010	+13 +20 +18	9
17	181101	13.9N 133.2E	700MB	2720	956		060 96 330 21	10 2	ELLIPTICAL	30 20 020	+13 +19 +13	10
18	181347	14.3N 132.9E	700MB	2734			230 92 230 21	12 2			+18 +12	10
19	182048	15.3N 132.5E	700MB	2722	957	65 360 60	170 82 090 18	10 5	CIRCULAR	30	+16 +20 +11	11
20	182333	15.7N 132.4E	700MB	2742	958	80 160 10	260 78 170 34	10 3	CIRCULAR	30	+1F +19 +10	11
21	190832	17.9N 132.3E	700MB	2630		80 090 10	100 87 090 10	8 4	CIRCULAR	15	+12 +20 +13	12
22	191105	18.4N 132.5E	700MB	2631	948		220 112 120 25	10 5	CIRCULAR	20	+13 +19 +13	12
23	192021	20.3N 132.8E	700MB	2598	942		020 111 020 10	6 6	ELLIPTICAL	25 20 360	+22 +19 +11	13
24	192337	20.7N 133.1E	700MB	2603	943	75 330 55	060 113 330 10	6 6	ELLIPTICAL	25 20 360	+14 +20 +11	13
25	200833	22.7N 135.1E	700MB	2681	952	110 250 10	200 105 100 24	7 1	CIRCULAR	20	+14 +16 +10	14
26	201113	23.4N 135.8E	700MB	2724			290 84 220 30	8 1			+10 +17 +11	14
27	202040	24.9N 139.0E	700MB	2949			200 62 040 5	15 15			+10 +16 +10	15
28	212356	27.9N 151.1E	1500FT		1003	35 110 60	250 50 120 30	5 3	CIRCULAR	5	+23 +22 +21	[illegible]

SYNOPTIC FIXES

FIX NO.	TIME (Z)	FIX POSITION	INTENSITY ESTIMATE	NEAREST DATA (NM)	COMMENTS
1	141200	6.3N 153.9E	030	055	SYNOP STATIONS 9[illegible]34 AND 91338
2	150900	8.3N 149.7E	035	065	SYNOP STATIONS 9[illegible]24 AND 91334

NOTICE - THE ASTERISKS (*) INDICATE FIXES UNREPRESENTATIVE AND NOT USED FOR BEST TRACK PURPOSES

TYPHOON DOYLE
BEST TRACK DATA

	BEST TRACK		WARNING		ERRORS		24 HOUR FORECAST		ERRORS		48 HOUR FORECAST		ERRORS		72 HOUR FORECAST		ERRORS	
MO/DA/HR	POSIT	WIND	POSIT	WIND	DST	WIND	POSIT	WIND	DST	WIND	POSIT	WIND	DST	WIND	POSIT	WIND	DST	WIND
120206Z	6.3 149.2	20	0.0 0.0	0.	-0.	0.	0.0 0.0	0	-0	0	0.0 0.0	0	-0	0	0.0 0.0	0	-0	0
120212Z	6.4 148.1	20	0.0 0.0	0.	-0.	0.	0.0 0.0	0.	-0	0	0.0 0.0	0.	-0	0	0.0 0.0	0	-0	0
120218Z	6.6 146.8	20	0.0 0.0	0.	-0.	0.	0.0 0.0	0.	-0	0	0.0 0.0	0	-0	0	0.0 0.0	0	-0	0
120300Z	6.9 145.4	20	0.0 0.0	0.	-0.	0.	0.0 0.0	0.	-0	0	0.0 0.0	0	-0	0	0.0 0.0	0	-0	0
120306Z	7.0 144.1	20	0.0 0.0	0.	-0.	0.	0.0 0.0	0.	-0	0	0.0 0.0	0	-0	0	0.0 0.0	0	-0	0
120312Z	7.2 142.9	20	0.0 0.0	0.	-0.	0.	0.0 0.0	0.	-0	0.	0.0 0.0	0	-0	0	0.0 0.0	0	-0	0
120318Z	7.4 141.9	20	0.0 0.0	0.	-0.	0.	0.0 0.0	0	-0	0	0.0 0.0	0	-0	0	0.0 0.0	0	-0	0
120400Z	7.5 141.0	25	0.0 0.0	0.	-0.	0.	0.0 0.0	0	-0	0.	0.0 0.0	0	-0	0	0.0 0.0	0	-0	0
120406Z	7.7 140.2	25	0.0 0.0	0.	-0.	0.	0.0 0.0	0	-0	0	0.0 0.0	0	-0	0	0.0 0.0	0	-0	0
120412Z	8.0 139.2	30	0.0 0.0	0.	-0.	0	0.0 0.0	0	-0	0	0.0 0.0	0	-0	0	0.0 0.0	0	-0	0
120418Z	8.3 138.3	35	8.5 138.4	30.	13.	-5.	9.4 134.6	55.	63	5	10.5 130.7	65	214	0	11.7 126.8	65	375	-40
120500Z	8.6 137.5	40	8.8 137.4	35.	13.	-5.	9.8 133.5	55.	97	5	11.2 129.3	70	265	-10	12.7 124.7	60	447	-50
120506Z	9.1 136.7	45	9.0 136.8	45.	8.	0.	9.9 133.1	65.	119	15	11.2 128.9	80	294	-10	12.8 124.2	65	463	-50
120512Z	9.6 136.0	50	9.6 135.8	50.	12.	0.	11.0 132.6	65.	101	10	12.4 129.2	70	239	-20	13.2 125.2	65	395	-50
120518Z	10.2 135.3	50	10.1 135.0	55.	19.	5.	12.0 131.6	65	118	0	13.3 127.8	70	272	-35	13.9 123.5	65	456	-55
120600Z	10.8 134.8	50	11.0 134.9	50.	13.	0.	13.7 132.4	65.	41	-15	15.1 129.0	65	162	-45	16.3 125.5	55	290	-70
120606Z	11.5 134.3	50	11.9 134.5	55.	27.	5.	14.1 132.1	65.	39	-25	15.3 129.1	60	141	-55	16.3 125.3	50	296	-70
120612Z	12.2 133.8	55	12.2 133.8	50.	0.	-5.	14.5 131.5	50.	55	-40	16.0 128.0	55	181	-60	16.9 124.0	50.	359	-45
120618Z	12.9 133.4	65	12.9 133.2	45.	12.	-20.	15.0 130.8	55.	70	-50	16.2 127.3	55	201	-65	16.9 123.1	50	412.	-15.
120700Z	13.6 133.1	80	13.5 133.1	75.	6.	-5.	15.6 131.2	100.	31	-10	16.4 128.8	105	113	-20	16.6 125.8	110	315	65.
120706Z	14.4 132.7	90	14.5 132.9	95.	13.	5.	16.3 131.2	120	17.	5	16.8 129.7	115	81	-5	17.0 127.5	110	281.	70
120712Z	15.0 132.3	90	15.1 132.5	90.	13.	0.	16.5 131.0	100.	6.	-15	17.0 129.0	90	117	-5	17.0 126.9	80.	382.	40
120718Z	15.5 131.9	105	15.6 132.2	100.	18.	-5.	16.8 130.8	105.	13	-15.	17.0 128.7	95	149	30	17.0 126.6	85	478	50
120800Z	15.8 131.7	110	15.7 131.9	110.	13.	0.	16.4 130.6	110	67.	-15.	17.7 128.9	100	149	55	19.5 127.1	90.	439	60.
120806Z	16.1 131.4	115	16.1 131.4	110.	0.	-5.	17.0 129.3	105.	80.	-15.	18.2 127.7	100	218	60.	19.8 126.3	90.	568.	65
120812Z	16.5 131.1	115	16.5 131.1	115.	0.	0.	17.7 129.7	105.	62.	10.	19.3 128.2	95	230	55.	0.0 0.0	0.	-0	0
120818Z	17.0 130.7	120	16.9 130.7	105.	6.	-15.	18.9 129.3	90	38	25.	21.2 128.6	80	230	45	0.0 0.0	0.	-0.	0.
120900Z	17.5 130.4	125	17.5 130.4	100.	0.	-25.	20.4 128.8	80.	79.	35.	25.2 130.1	65	196.	35	0.0 0.0	0.	-0.	0.
120906Z	18.1 130.1	120	18.4 130.1	100.	18.	-20.	22.6 129.1	75.	130.	35.	27.7 132.4	60.	223.	35.	0.0 0.0	0.	-0.	0.
120912Z	18.7 130.0	95	18.7 129.8	90.	11.	-5.	22.7 129.2	65.	121.	25.	0.0 0.0	0.	-0	0	0.0 0.0	0.	-0.	0.
120918Z	19.2 129.9	65	19.7 130.2	80.	34.	15.	24.4 133.0	55.	98.	20.	0.0 0.0	0.	-0	0	0.0 0.0	0.	-0.	0.
121000Z	19.9 130.1	45	20.1 130.1	45.	12.	0.	25.0 134.0	25.	74	-5.	0.0 0.0	0	-0	0	0.0 0.0	0.	-0.	0.
121006Z	20.8 130.4	40	21.0 130.6	40.	16.	0.	0.0 0.0	0.	-0	0.	0.0 0.0	0.	-0.	0	0.0 0.0	0.	-0.	0.
121012Z	21.9 131.2	40	21.4 131.3	40.	31.	0.	0.0 0.0	0	-0.	0.	0.0 0.0	0.	-0.	0	0.0 0.0	0.	-0.	0.
121018Z	22.9 132.3	35	0.0 0.0	0.	-0.	0.	0.0 0.0	0	-0	0	0.0 0.0	0.	-0	0.	0.0 0.0	0.	-0.	0.
121100Z	23.9 133.4	30	23.9 133.5	30.	5.	0.	0.0 0.0	0.	-0.	0.	0.0 0.0	0.	-0	0	0.0 0.0	0.	-0.	0.
121106Z	24.8 135.0	25	25.0 134.5	25.	30.	0.	0.0 0.0	0.	-0.	0.	0.0 0.0	0.	-0.	0	0.0 0.0	0.	-0.	0.

	ALL FORECASTS				TYPHOONS WHILE OVER 35 KTS			
	WRNG	24-HR	48-HR	72-HR	WRNG	24-HR	48-HR	72-HR
AVG FORECAST POSIT ERROR	13.	69.	193.	397.	13.	69.	192.	381
AVG RIGHT ANGLE ERROR	10.	58.	161.	310.	9.	59.	156.	329.
AVG INTENSITY MAGNITUDE ERROR	6.	18.	34.	53.	6.	19.	34.	52.
AVG INTENSITY BIAS	-3.	-1.	-1.	-6.	-4.	-0.	-5.	-17
NUMBER OF FORECASTS	26	22	19	15	24	21	17	13

DISTANCE TRAVELED BY TROPICAL CYCLONE IS 1960. NM

AVERAGE SPEED OF TROPICAL CYCLONE IS 9. KNOTS

TYPHOON DOYLE
FIX POSITIONS FOR CYCLONE NO. 30

SATELLITE FIXES

FIX NO.	TIME (Z)	FIX POSITION	ACCRY	DVORAK CODE	COMMENTS	SITE
1	020857	6.6N 148.4E	PCN 5	T1.0/1.0	INIT OBS	PGTW
2	021200	6.8N 148.2E	PCN 6			PGTW
3	021600	7.0N 147.7E	PCN 6	T1.0/1.0	INIT OBS	PGTW
4	021800	7.2N 147.5E	PCN 6			PGTW
* 5	021955	7.3N 147.4E	PCN 5			PGTW
6	030000	7.1N 144.7E	PCN 6			PGTW
7	030300	7.2N 145.6E	PCN 6	T1.5/1.5 /D0.5/24HRS	ULCC 7.2N 144.7E	PGTW
8	030600	7.5N 143.9E	PCN 6		ULCC FIX	PGTW
9	030835	7.5N 143.3E	PCN 5		ULCC FIX	PGTW
10	031200	7.9N 142.9E	PCN 6		ULCC FIX	PGTW
11	031600	7.6N 142.3E	PCN 6	T1.0/1.0+/S0.0/24HRS	ULCC FIX	PGTW
12	031800	7.4N 141.8E	PCN 6		ULCC FIX	PGTW
13	031844	7.5N 141.9E	PCN 6		ULCC FIX	PGTW
14	032115	8.3N 140.8E	PCN 6		ULCC FIX	PGTW
15	040000	8.3N 142.4E	PCN 6		ULCC FIX	PGTW
16	040045	8.3N 141.9E	PCN 5			PGTW
* 17	040300	8.5N 141.7E	PCN 6	T2.0/2.0 /D0.5/24HRS		PGTW
* 18	040546	8.6N 141.7E	PCN 6			PGTW
19	040855	8.2N 140.0E	PCN 5			PGTW
* 20	040900	8.7N 141.5E	PCN 6			PGTW
21	041200	8.0N 139.6E	PCN 6		ULCC FIX	PGTW
22	041326	8.1N 139.3E	PCN 5		ULCC FIX	PGTW
23	041600	8.5N 138.7E	PCN 6	T2.5/2.5 /D1.5/24HRS	ULCC FIX	PGTW
24	041800	8.5N 138.3E	PCN 6		ULCC FIX	PGTW
25	042054	8.9N 137.6E	PCN 5		ULCC FIX	PGTW
26	050000	8.7N 137.5E	PCN 6			PGTW
27	050300	9.0N 136.7E	PCN 6	T3.0/3.0 /D1.0/24HRS		PGTW
28	050600	9.2N 136.6E	PCN 6			PGTW
29	050716	9.6N 136.5E	PCN 6			RODN
30	050900	9.4N 136.2E	PCN 6			PGTW
* 31	050934	9.9N 135.2E	PCN 4			RODN
32	051012	9.9N 135.7E	PCN 5			RPMK
33	051200	9.7N 135.6E	PCN 6			PGTW
34	051306	10.0N 135.5E	PCN 3			RPMK
35	051600	10.4N 135.4E	PCN 6	T3.5/3.5-/D1.0/24HRS		PGTW
36	051800	10.8N 134.6E	PCN 6			PGTW
37	051819	10.1N 134.8E	PCN 4			RODN
* 38	052033	10.7N 134.1E	PCN 4			RODN
39	052100	10.6N 134.7E	PCN 6			PGTW
40	052250	10.2N 135.0E	PCN 3	T3.0/3.0	INIT OBS	RPMK
41	060000	11.1N 135.1E	PCN 4			PGTW
* 42	060146	11.7N 134.1E	PCN 3	T3.5/3.5	INIT OBS	RODN
43	060300	11.5N 135.0E	PCN 4	T3.5/3.5 /D0.5/24HRS		PGTW
44	060600	11.9N 134.2E	PCN 4			PGTW
45	060900	11.7N 133.9E	PCN 4			PGTW
46	060913	11.7N 133.9E	PCN 4			RODN
47	060947	11.9N 133.5E	PCN 4			RODN
48	061200	12.2N 133.6E	PCN 4			PGTW
49	061600	12.4N 133.0E	PCN 4	T4.0/4.0 /D0.5/24HRS		PGTW
50	061800	13.1N 133.4E	PCN 4			PGTW
51	062100	13.4N 133.5E	PCN 6			PGTW
52	062226	13.2N 133.4E	PCN 3	T4.0/4.0 /D1.0/24HRS		RPMK
53	070000	13.5N 133.1E	PCN 4			PGTW
54	070126	13.9N 133.2E	PCN 1	T5.0/5.0+/D1.5/24HRS	40 PCT EYEWALL E-SW	RODN
55	070300	14.1N 133.1E	PCN 2	T5.0/5.0 /D1.5/24HRS	EYE DIA 5NM	PGTW
56	070600	14.6N 132.9E	PCN 2		EYE FIX	PGTW
57	070900	14.8N 132.6E	PCN 2		EYE FIX	PGTW
58	070923	14.8N 132.5E	PCN 2		EYE FIX	RODN
59	071033	15.5N 131.9E	PCN 3			RPMK
60	071200	15.1N 132.4E	PCN 2		EYE FIX	PGTW
61	071407	15.2N 132.5E	PCN 1			RPMK
62	071600	15.3N 132.3E	PCN 2	T5.5/5.5 /D1.5/24HRS		PGTW
63	071800	15.6N 132.2E	PCN 2			PGTW
64	072100	15.6N 131.9E	PCN 2			PGTW
65	072131	15.6N 131.7E	PCN 2			RODN

66	072132	15.5N 132.2E	PCN 1	T5.0/5.0 /D1.0/24HRS	EYE FIX	RPMK
67	072202	15.7N 131.7E	PCN 2		EYE FIX 50 PCT EYEWALL	RODN
68	080000	15.7N 131.9E	PCN 2			PGTW
69	080106	15.7N 131.8E	PCN 1			RPMK
70	080300	16.0N 131.6E	PCN 2	T5.5/5.5-/D0.5/24HRS		PGTW
71	080600	16.1N 131.4E	PCN 2			PGTW
72	080900	16.2N 131.3E	PCN 2			PGTW
73	081011	16.3N 131.0E	PCN 2		EYE FIX	RODN
74	081040	16.5N 131.7E	PCN 1		EYE FIX	RPMK
75	081200	16.5N 131.2E	PCN 2			PGTW
76	081347	16.5N 131.2E	PCN 1		EYE FIX	RPMK
77	081600	16.8N 130.9E	PCN 4	T5.0/5.5 /W0.5/24HRS		PGTW
78	081800	17.0N 130.7E	PCN 4			PGTW
79	082111	16.5N 130.5E	PCN 4			RODN
80	082319	17.1N 130.8E	PCN 4			RODN
81	082319	17.1N 131.1E	PCN 3	T5.0/5.0-/S0.0/26HRS		RPMK
82	090000	17.5N 130.6E	PCN 4			PGTW
83	090046	17.3N 130.5E	PCN 3			RPMK
84	090300	17.9N 130.3E	PCN 4	T4.5/5.5 /W1.0/24HRS		PGTW
85	090600	18.4N 130.1E	PCN 4		ULCC FIX	PGTW
86	090626	17.8N 130.1E	PCN 5			RPMK
87	090900	18.7N 129.9E	PCN 6			PGTW
88	090951	18.8N 129.9E	PCN 6			RODN
89	091016	18.8N 129.9E	PCN 6			RODN
90	091200	19.1N 130.1E	PCN 6			PGTW
* 91	091326	20.0N 131.2E	PCN 5			RPMK
92	091600	19.5N 130.8E	PCN 6	T3.0/4.0+/W2.0/24HRS		PGTW
93	091800	20.0N 131.3E	PCN 6		ULCC FIX	PGTW
94	091910	20.1N 131.5E	PCN 6			RPMK
95	092049	20.0N 130.7E	PCN 6			RODN
96	092100	20.1N 132.0E	PCN 6		ULCC FIX	PGTW
97	092254	20.3N 131.3E	PCN 6		ULCC FIX	RODN
98	100000	20.4N 130.5E	PCN 6		ULCC FIX	PGTW
99	100026	20.2N 130.6E	PCN 6	T3.5/4.5 /W1.5/25HRS		RPMK
100	100300	20.5N 130.3E	PCN 6	T3.0/4.0 /W1.5/24HRS		PGTW
101	100600	21.4N 130.7E	PCN 6		ULCC FIX	PGTW
*102	100626	21.4N 131.2E	PCN 3			RPMK
103	100900	21.4N 130.8E	PCN 6		ULCC FIX	PGTW
104	101200	21.2N 131.1E	PCN 6		ULCC 21.4N 132.8E	PGTW
*105	101600	23.2N 133.5E	PCN 6		ULCC FIX	PGTW
106	101800	23.1N 134.1E	PCN 6			PGTW
107	101857	23.0N 133.2E	PCN 6			RODN
108	102100	23.2N 134.7E	PCN 6			PGTW
109	102230	22.8N 135.0E	PCN 6		ULCC FIX	RODN
110	110000	23.8N 133.6E	PCN 4	T1.5/2.5 /W1.5/21HRS	EXP LLCC	PGTW
111	110005	23.2N 133.0E	PCN 6	T1.5/1.5	INIT OBS	RODN
112	110005	23.2N 133.3E	PCN 6	T1.5/1.5	INIT OBS	RSKO
113	110600	24.6N 135.0E	PCN 4			PGTW
114	110601	24.4N 135.4E	PCN 3	T1.5/2.5 /W2.0/30HRS	EXP LLCC	RPMK
115	120300	29.9N 144.9E	PCN 6			PGTW

AIRCRAFT FIXES

FIX NO	TIME (Z)	FIX POSITION	FLT LVL	700MB HGT	OBS MSLP	MAX-SFC-WND VEL	BRG	RNG	MAX-FLT-LVL-WND DIR	VEL	BRG	RNG	ACCRY NAV	MET	EYE SHAPE	EYE DIAM	ORIEN-TATION	EYE TEMP (C) OUT	IN	DP	SST	MSN NO.
1	050129	8.7N 137.3E	1500FT		994	40	180	5	280	35	180	5	5	2				+23	+27	+23		4
2	050533	9.1N 137.0E	1500FT		993	45	200	15	110	41	010	86	6	2				+27	+29	+26		5
3	052030	10.6N 135.3E	700MB	2955		40	350	40	160	47	110	35	10	10	CIRCULAR	70		+14	+15	+ 8		6
4	052336	11.1N 135.1E	1500FT		991	50	140	30	250	48	150	5	10	10	CIRCULAR	60		+25	+27	+25	30	6
5	060852	11.8N 134.0E	700MB	2997	989	50	070	50	140	45	060	60	10	5	CIRCULAR	20		+15	+17	+11		7
6	061124	12.0N 133.8E	700MB	2998	991				290	35	230	60	8	5				+14	+17	+12		7
7	062034	13.1N 133.5E	700MB	2910	978				090	62	010	14	12	5	ELLIPTICAL	15 10	080	+16	+19	+12		8
8	062336	13.5N 133.2E	700MB	2876	973	90	360	10	280	74	190	08	10	5	CIRCULAR	20		+15	+19	+12		8
9	070932	14.8N 132.6E	700MB	2676					150	89	060	20	8	2	CIRCULAR	8		+14	+19	+13		9
10	071137	15.1N 132.4E	700MB	2685	953				260	89	170	14	10	2	CIRCULAR	12		+15	+18	+14		9
11	072047	15.6N 131.8E	700MB	2526	935	45	310	120	080	99	020	10	5	2	ELLIPTICAL	15 10	210	+14	+19	+14		10
12	072329	15.8N 131.8E	700MB	2570	940	110	240	10	190	95	120	30	5	3	ELLIPTICAL	15 10	280	+14	+20	+13		10
13	080835	16.2N 131.2E	700MB	2585	944	120	090	15	140	113	030	10	5	3	CIRCULAR	20		+11	+16	+15		11
14	081106	16.4N 131.2E	700MB	2562					260	101	180	10	3	5	CIRCULAR	20		+ 9	+17	+15		11
15	082044	17.2N 130.5E	700MB	2642					180	110	120	23	8	5	CIRCULAR	20		+13	+21	+12		12
16	082339	17.4N 130.5E	700MB	2675	951	130	090	5	190	125	160	20	8	5	CIRCULAR	20		+13	+21	+11		12
17	090843	18.4N 130.1E	700MB	2891	972	120	100	24	100	74	360	69	10	1	CIRCULAR	40		+18	+21	+ 4		13
18	091123	18.8N 129.8E	700MB	3011	987				280	40	190	35	8	5				+22	+24	+ 3		13
19	092037	19.4N 130.3E	700MB	3041	993				150	50	010	60	5	5				+22	+21	+ 7		14
20	092337	20.1N 130.0E	1500FT		993	50	130	50	300	43	200	72	5	5				+28	+27	+25		14
21	100559	20.9N 130.6E	1500FT		993	50	020	30	230	38	150	67	5	5				+24	+24	+24		15
22	100835	21.2N 130.8E	1500FT		996	25	280	35	350	35	280	35	15	5				+24	+24	+24		15
23	102212	23.5N 133.0E	1500FT		1002	40	140	50	220	49	140	78	8	5				+27	+29	+24		16
24	110059	24.2N 133.5E	1500FT		1004	15	340	10	350	31	260	25	8	2				26+	27+	24		16

NOTICE - THE ASTERISKS (*) INDICATE FIXES UNREPRESENTATIVE AND NOT USED FOR BEST TRACK PURPOSES

2. NORTH INDIAN OCEAN CYCLONE DATA

TROPICAL CYCLONE 01-84
BEST TRACK DATA

	BEST TRACK			WARNING			ERRORS		24 HOUR FORECAST			ERRORS		48 HOUR FORECAST			ERRORS		72 HOUR FORECAST			ERRORS	
MO/DA/HR	POSIT		WIND	POSIT		WIND	DST	WIND	POSIT		WIND	DST	WIND	POSIT		WIND	DST	WIND	POSIT		WIND	DST	WIND
052312Z	10.7	56.2	20	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
052318Z	10.9	56.0	20	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
052400Z	11.1	55.7	20	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
052406Z	11.3	55.5	20	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
052412Z	11.5	55.3	20	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
052418Z	11.7	55.2	25	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
052500Z	11.9	54.9	25	0.0	0.0	0.	-0.	0	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
052506Z	12.1	54.7	25	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
052512Z	12.2	54.4	30	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
052518Z	12.4	53.9	30	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
052600Z	12.7	53.4	35	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
052606Z	13.0	53.0	35	13.2	53.0	35.	12.	0.	14.8	50.1	45.	126.	0	15.4	46.5	20.	347.	-10.	0.0	0.0	0.	-0.	0.
052612Z	13.2	52.4	40	13.7	52.4	40.	30.	0.	15.0	49.4	35.	193.	-5.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
052618Z	13.5	51.7	40	13.4	51.9	40.	13.	0.	13.8	49.5	55.	249.	20.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
052700Z	13.5	50.4	45	13.7	51.2	45.	48.	0.	14.2	48.5	40.	294.	5.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
052706Z	13.0	49.0	45	13.7	49.8	45.	63.	0.	13.8	46.7	30.	265.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
052712Z	12.3	47.6	40	13.3	48.0	45.	64.	5.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
052718Z	11.6	45.9	35	11.6	46.3	40.	24.	5.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
052800Z	10.9	44.8	35	11.1	44.5	40.	21.	5.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
052806Z	10.0	44.4	30	10.0	44.3	30.	6.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.

	ALL FORECASTS				TYPHOONS WHILE OVER 35 KTS			
	WRNG	24-HR	48-HR	72-HR	WRNG	24-HR	48-HR	72-HR
AVG FORECAST POSIT ERROR	31.	225.	347.	0.	0.	0.	0.	0.
AVG RIGHT ANGLE ERROR	19.	79.	195.	0.	0.	0.	0.	0.
AVG INTENSITY MAGNITUDE ERROR	2.	6.	10.	0.	0.	0.	0.	0.
AVG INTENSITY BIAS	2.	4.	-10.	0.	0.	0.	0.	0.
NUMBER OF FORECASTS	9	5	1	0	0	0	0	0

DISTANCE TRAVELED BY TROPICAL CYCLONE IS 819. NM

AVERAGE SPEED OF TROPICAL CYCLONE IS 7. KNOTS

TC01A
FIX POSITIONS FOR CYCLONE NO. 1

SATELLITE FIXES

FIX NO.	TIME (Z)	FIX POSITION		ACCRY	DVORAK CODE	COMMENTS	SITE
1	231444	10.9N	56.2E	PCN 5	T1.0/1.0	INIT OBS	KGWC
2	232333	6.0N	54.0E	PCN 6			FJDG
3	240658	11.2N	55.3E	PCN 5	T1.5/1.5 /D0.5/16HRS	ULAC 10.8N 54.4E	KGWC
4	250638	12.5N	55.4E	PCN 5	T1.5/1.5 /S0.0/24HRS	ULAC 11.4N 56.8E	KGWC
5	251918	12.2N	53.7E	PCN 6			KGWC
6	260050	12.9N	53.1E	PCN 5		ULAC 12.3N 53.4E	KGWC
7	260241	13.0N	53.4E	PCN 5		ULAC 12.6N 53.6E	KGWC
8	260617	13.3N	53.1E	PCN 5	T2.5/2.5 /D1.0/24HRS	ULAC 12.8N 53.2E	KGWC
9	261153	13.2N	52.6E	PCN 5		ULAC 12.9N 52.7E	KGWC
10	261521	13.1N	52.1E	PCN 5		ULAC 12.6N 52.4E	KGWC
11	261858	13.6N	51.6E	PCN 5		ULAC 13.1N 51.7E	KGWC
12	270037	13.4N	50.4E	PCN 5		ULAC 13.2N 50.1E	KGWC
13	270220	13.5N	49.9E	PCN 5	T2.5/2.5 /S0.0/22HRS	ULAC 13.0N 49.3E	KGWC
14	271140	12.1N	47.7E	PCN 5		ULAC 11.8N 47.7E	KGWC
15	271500	11.7N	46.7E	PCN 5		ULAC 11.9N 47.0E	KGWC
16	271838	11.6N	45.3E	PCN 5		ULAC 11.4N 45.3E	KGWC
17	280025	11.2N	44.7E	PCN 6		ULAC 11.8N 45.0E	KGWC
18	280340	9.9N	44.9E	PCN 5			KGWC

NOTICE - THE ASTERISKS (*) INDICATE FIXES UNREPRESENTATIVE AND NOT USED FOR BEST TRACK PURPOSES

TROPICAL CYCLONE 02-84 BEST TRACK DATA

	BEST TRACK			WARNING			ERRORS		24 HOUR FORECAST			ERRORS		48 HOUR FORECAST			ERRORS		72 HOUR FORECAST			ERRORS	
MO/DA/HR	POSIT		WIND	POSIT		WIND	DST	WIND	POSIT		WIND	DST	WIND	POSIT		WIND	DST	WIND	POSIT		WIND	DST	WIND
101012Z	16.8	88.6	25	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
101018Z	17.5	88.6	25	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
101100Z	17.7	88.6	25	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
101106Z	18.0	88.6	30	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
101112Z	18.2	88.6	30	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
101118Z	18.4	88.6	35	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
101200Z	18.7	88.6	35	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
101206Z	19.0	88.6	40	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
101212Z	19.2	88.5	40	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
101218Z	19.5	88.4	45	19.5	88.8	45.	23.	0.	22.3	88.3	50.	113.	15.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
101300Z	19.7	88.3	45	19.8	88.3	45.	6.	0.	21.5	87.7	60.	37.	25.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
101306Z	19.9	88.1	45	19.2	87.8	55.	45.	10.	20.9	86.8	60.	43.	25.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
101312Z	20.2	87.9	40	19.9	88.3	45.	29.	5.	21.2	87.1	35.	90.	5.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
101318Z	20.5	87.7	35	20.3	87.9	45.	16.	10.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
101400Z	21.0	87.3	35	20.6	87.8	40.	37.	5.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
101406Z	21.6	86.6	35	21.0	87.0	40.	42.	5.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
101412Z	22.2	85.9	30	21.7	86.3	30.	37.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.

	ALL FORECASTS				TYPHOONS WHILE OVER 35 KTS			
	WRNG	24-HR	48-HR	72-HR	WRNG	24-HR	48-HR	72-HR
AVG FORECAST POSIT ERROR	29.	71.	0.	0.	0.	0.	0.	0.
AVG RIGHT ANGLE ERROR	13.	40.	0.	0.	0.	0.	0.	0.
AVG INTENSITY MAGNITUDE ERROR	4.	18.	0.	0.	0.	0.	0.	0.
AVG INTENSITY BIAS	4.	18.	0.	0.	0.	0.	0.	0.
NUMBER OF FORECASTS	8	4	0	0	0	0	0	0

DISTANCE TRAVELED BY TROPICAL CYCLONE IS 380. NM

AVERAGE SPEED OF TROPICAL CYCLONE IS 4. KNOTS

TC02B
FIX POSITIONS FOR CYCLONE NO. 2

SATELLITE FIXES

FIX NO.	TIME (Z)	FIX POSITION		ACCRY	DVORAK CODE	COMMENTS	SITE
1	101200	16.9N	89.5E	PCN 6		ULCC FIX	PGTW
* 2	101600	18.0N	90.0E	PCN 6		ULCC FIX	PGTW
3	101645	17.0N	87.8E	PCN 5	T1.5/1.5	INIT OBS ULAC 18.0N 90.3E	KGWC
4	101800	18.1N	89.0E	PCN 6	T2.0/2.0	INIT OBS	PGTW
5	102100	18.5N	88.8E	PCN 6		ULCC FIX	PGTW
6	110345	17.5N	88.5E	PCN 5	T1.5/1.5 /D0.5/11HRS	ULAC 18.9N 89.8E	KGWC
* 7	111016	18.4N	89.7E	PCN 6		ULAC 19.0N 089.7E	KGWC
* 8	111200	19.0N	87.6E	PCN 6			PGTW
9	111209	19.4N	88.1E	PCN 5		ULAC 19.1N 89.1E	KGWC
10	111600	18.6N	87.9E	PCN 6			PGTW
11	111625	19.1N	88.7E	PCN 5		ULAC 19.1N 89.6E	KGWC
12	111800	18.4N	88.5E	PCN 6	T2.0/2.0 /S0.0/24HRS		PGTW
13	112100	18.8N	88.7E	PCN 6			PGTW
* 14	112300	20.2N	89.4E	PCN 6			KGWC
. 15	120049	19.6N	90.1E	PCN 5			KGWC
* 16	120324	18.7N	89.8E	PCN 5	T2.0/2.0 /D0.5/24HRS	ULAC 18.8N 088.0E	KGWC
* 17	121003	18.7N	89.8E	PCN 4		ULAC 18.0N 089.0E	KGWC
18	121329	19.1N	88.9E	PCN 6		ULAC 20.1N 88.0E	KGWC
19	121600	19.0N	88.5E	PCN 6			PGTW
20	121605	19.1N	88.8E	PCN 6		ULAC 21.0N 87.6E	KGWC
21	121800	19.4N	88.3E	PCN 6	T3.0/3.0 /D1.0/24HRS		PGTW
22	122248	20.0N	88.0E	PCN 5			KGWC
23	130000	19.7N	87.9E	PCN 6			PGTW
24	130028	19.9N	88.4E	PCN 5		ULAC 18.9N 88.2E	KGWC
* 25	130400	19.0N	87.0E	PCN 6		ULCC FIX	PGTW
26	130446	19.3N	89.2E	PCN 5	T3 0/3.0 /D1.0/25HRS	ULAC 18.8N 89 1E	KGWC
27	130600	19.2N	87.9E	PCN 6		ULCC FIX	PGTW
28	130900	19.8N	87.5E	PCN 6		ULCC FIX	PGTW
* 29	130951	19.8N	88.7E	PCN 2		EXP LLCC ULAC 19.9N 085.5E	KGWC
* 30	131200	19.6N	87.0E	PCN 6		ULCC FIX	PGTW
31	131308	20.4N	88.5E	PCN 6			KGWC
32	131545	20.2N	88.2E	PCN 6			KGWC
33	131600	20.3N	87.5E	PCN 6	T2.5/3.0-/W0.″/22HRS	ULCC FIX	PGTW
* 34	132100	19.9N	86.9E	PCN 6			PGTW
* 35	132235	20.9N	88.7E	PCN 6			KGWC
* 36	140000	20.0N	86.8E	PCN 6		ULCC FIX	PGTW
37	140007	21.7N	87.7E	PCN 6		ULAC 20 4N 86.9E	KGWC
38	140400	21.0N	86.6E	PCN 6		ULCC FIX	PGTW
39	140425	20.9N	86.2E	PCN 5			KGWC
40	140600	21.2N	86.7E	PCN 6		ULCC FIX	PGTW

SYNOPTIC FIXES

FIX NO	TIME (Z)	FIX POSITION		INTENSITY ESTIMATE	NEAREST DATA (NM)	COMMENTS
1	140300	21.0N	87.2E	040	045	42895 42973 42977
2	141200	21.7N	86.3E	030	030	42895 42971 42798

NOTICE - THE ASTERISKS (*) INDICATE FIXES UNREPRESENTATIVE AND NOT USED FOR BEST TRACK PURPOSES

TROPICAL CYCLONE 03-84
BEST TRACK DATA

MO/DA/HR	BEST TRACK POSIT		BEST TRACK WIND	WARNING POSIT		WARNING WIND	WARNING ERRORS DST	WARNING ERRORS WIND	24 HOUR FORECAST POSIT		24 HOUR FORECAST WIND	24 HR ERRORS DST	24 HR ERRORS WIND
110900Z	8.8	88.0	20	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
110906Z	9.0	87.3	25	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
110912Z	9.3	86.8	25	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
110918Z	9.6	86.2	30	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
111000Z	9.9	85.6	30	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
111006Z	10.0	85.0	30	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
111012Z	10.2	84.2	30	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
111018Z	10.3	83.6	35	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
111100Z	10.4	82.8	40	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
111106Z	10.5	82.1	50	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
111112Z	10.8	81.4	60	10.6	81.2	40.	17.	-20.	10.9	78.6	30.	164.	-50.
111118Z	11.1	81.0	70	10.9	80.6	50.	26.	-20.	11.2	78.1	30.	206.	-55.
111200Z	11.6	80.7	75	11.7	80.4	55.	19.	-20.	0.0	0.0	0.	-0.	0.
111206Z	12.2	80.7	80	12.5	80.6	80.	19.	0.	14.8	79.2	45.	122.	-40.
111212Z	12.8	80.6	80	13.0	80.6	75.	12.	-5.	15.2	78.9	30.	150.	-55.
111218Z	13.5	80.7	85	13.5	80.3	65.	23.	-20.	0.0	0.0	0.	-0.	0.
111300Z	13.9	80.8	85	14.0	80.6	70.	13.	-15.	15.9	79.8	30.	129.	-50.
111306Z	13.6	80.9	85	14.7	80.7	70.	67.	-15.	0.0	0.0	0.	-0.	0.
111312Z	13.4	80.7	85	14.3	80.7	70.	54.	-15.	15.5	80.7	60.	95.	-10.
111318Z	13.5	80.4	85	14.0	80.7	70.	35.	-15.	15.1	80.7	65.	67.	5.
111400Z	13.8	80.3	80	13.8	80.3	90.	0.	10.	16.0	79.3	50.	123.	5.
111406Z	14.0	80.3	75	13.9	79.9	80.	24.	5.	16.1	79.1	30.	133.	-5.
111412Z	14.0	80.2	70	14.3	79.9	75.	25.	5.	0.0	0.0	0.	-0.	0.
111418Z	14.1	80.2	60	14.5	80.3	65.	25.	5.	0.0	0.0	0.	-0.	0.
111500Z	14.1	80.1	45	13.7	80.0	50.	25.	5.	0.0	0.0	0.	-0.	0.
111506Z	14.1	80.1	35	13.6	80.0	35.	31.	0.	0.0	0.0	0.	-0.	0.

MO/DA/HR	48 HOUR FORECAST POSIT		48 HOUR FORECAST WIND	48 HR ERRORS DST	48 HR ERRORS WIND	72 HOUR FORECAST POSIT		72 HOUR FORECAST WIND	72 HR ERRORS DST	72 HR ERRORS WIND
110900Z	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
110906Z	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
110912Z	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
110918Z	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
111000Z	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
111006Z	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
111012Z	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
111018Z	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
111100Z	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
111106Z	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
111112Z	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
111118Z	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
111200Z	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
111206Z	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
111212Z	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
111218Z	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
111300Z	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
111306Z	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
111312Z	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
111318Z	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
111400Z	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
111406Z	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
111412Z	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
111418Z	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
111500Z	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
111506Z	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.

	ALL FORECASTS WRNG	24-HR	48-HR	72-HR	TYPHOONS WHILE OVER 35 KTS WRNG	24-HR	48-HR	72-HR
AVG FORECAST POSIT ERROR	26.	132.	0.	0.	0.	0.	0.	0.
AVG RIGHT ANGLE ERROR	16.	107.	0.	0.	0.	0.	0.	0.
AVG INTENSITY MAGNITUDE ERROR	11.	31.	0.	0.	0.	0.	0.	0.
AVG INTENSITY BIAS	-7.	-28.	0.	0.	0.	0.	0.	0.
NUMBER OF FORECASTS	16	9	0	0	0	0	0	0

DISTANCE TRAVELED BY TROPICAL CYCLONE IS 719. NM

AVERAGE SPEED OF TROPICAL CYCLONE IS 5. KNOTS

TC03B
FIX POSITIONS FOR CYCLONE NO. 3

SATELLITE FIXES

FIX NO.	TIME (Z)	FIX POSITION		ACCRY	DVORAK CODE	COMMENTS	SITE
1	090300	9.4N	87.3E	PCN 6	T1.0/1.0	INIT OBS	PGTW
2	090407	8.6N	87.5E	PCN 5	T1.5/1.5	INIT OBS	KGWC
3	090600	9.0N	87.0E	PCN 6			PGTW
4	090900	9.3N	86.5E	PCN 6			PGTW
5	091600	9.7N	87.2E	PCN 6	T1.0/1.0	INIT OBS	PGTW
* 6	091647	9.3N	87.8E	PCN 5		ULAC 10.1N 087.5E	KGWC
7	100346	10.4N	85.6E	PCN 5	T2.0/2.0 /D0.5/24HRS	ULAC 09.5N 085.9E	KGWC
8	110020	10.3N	82.3E	PCN 6		ULAC 09.8N 082.6E	KGWC
9	110508	10.4N	82.6E	PCN 5	T3.5/3.5 /D1.5/25HRS		KGWC
10	111035	10.8N	81.3E	PCN 5			KGWC
11	111300	11.0N	87.5E	PCN 5		ULAC 11.3N 081.7E	KGWC
12	111607	11.2N	81.1E	PCN 5			KGWC
13	112359	11.7N	80.5E	PCN 5			KGWC
14	120148	13.0N	81.0E	PCN 6	T2.5/2.5	INIT OBS	FJDG
15	120447	12.4N	80.8E	PCN 1	T5.0/5.0 /D1.5/24HRS	EYE DIA 6NM	KGWC
16	121022	12.8N	80.9E	PCN 1			KGWC
17	121238	12.8N	80.4E	PCN 1		EYE FIX	KGWC
18	121728	13.4N	80.7E	PCN 1		EYE FIX	KGWC
19	122307	13.7N	80.7E	PCN 1		EYE FIX	KGWC
20	122308	13.5N	81.0E	PCN 5	T4.5/4.5 /D2.0/24HRS		FJDG
21	130119	14.0N	81.0E	PCN 2		EYE DIA 15NM	KGWC
22	130427	14.8N	80.7E	PCN 1	T5.5/5.5 /D0.5/24HRS	EYE FIX	KGWC
23	131010	13.4N	80.7E	PCN 1			KGWC
24	131359	13.3N	80.9E	PCN 1		EYE FIX	KGWC
25	131708	13.4N	80.3E	PCN 1		EYE FIX	KGWC
26	132254	14.0N	80.2E	PCN 1		EYE FIX	KGWC
27	140057	13.9N	80.4E	PCN 1		EYE FIX	KGWC
28	140407	13.7N	79.9E	PCN 1			KGWC
29	140957	14.2N	80.2E	PCN 1			KGWC
30	141337	13.8N	80.8E	PCN 5		ULAC 13.3N 080.4E	KGWC
31	141647	14.0N	80.9E	PCN 5		ULAC 13.8N 080.6E	KGWC
32	142242	13.7N	80.0E	PCN 5			KGWC
33	150036	14.0N	80.4E	PCN 5			KGWC
34	150528	13.4N	80.1E	PCN 5			KGWC
35	150944	13.8N	80.3E	PCN 5			KGWC
36	151627	13.6N	80.4E	PCN 5			KGWC
37	160508	14.1N	80.0E	PCN 5			KGWC

SYNOPTIC FIXES

FIX NO	TIME (Z)	FIX POSITION		INTENSITY ESTIMATE	NEAREST DATA (NM)	COMMENTS
1	130300	13.8N	80.5E	070	050	STATIONS 43245 AND 43279
2	130900	13.7N	80.2E	070	045	STATIONS 43245 AND 43279
3	142100	13.7N	80.0E	030	030	STATIONS 43245 AND 43279

NOTICE - THE ASTERISKS (*) INDICATE FIXES UNREPRESENTATIVE AND NOT USED FOR BEST TRACK PURPOSES.

TROPICAL CYCLONE 04-84
BEST TRACK DATA

	BEST TRACK			WARNING			ERRORS		24 HOUR FORECAST			ERRORS		48 HOUR FORECAST			ERRORS		72 HOUR FORECAST			ERRORS	
MO/DA/HR	POSIT		WIND	POSIT		WIND	DST	WIND	POSIT		WIND	DST	WIND	POSIT		WIND	DST	WIND	POSIT		WIND	DST	WIND
112706Z	8.4	85.8	25	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
112712Z	8.6	85.5	25	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
112718Z	8.8	85.2	30	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
112800Z	9.0	84.9	30	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
112806Z	9.3	84.7	35	9.4	85.0	35.	19.	0.	10.4	83.5	50	113	5.	11.6	81.3	65	214.	5.	12.4	79.3	40	126.	-35.
112812Z	9.7	84.6	40	9.8	84.6	40.	6	0	11.2	83.0	60	178	10	12.5	81.0	70.	216.	5.	13.4	79.3	35.	102.	-30.
112818Z	10.2	84.7	40	10.3	84.4	40.	19.	0.	11.7	82.8	55.	206.	5.	12.9	80.8	65.	190.	0.	13.4	78.8	35.	102.	5.
112900Z	10.3	85.1	45	10.7	84.5	45.	43.	0.	11.7	83.0	55.	173.	0	12.4	80.6	70	136	0	12.7	78.2	30.	134.	10.
112906Z	10.2	85.4	45	10.3	85.0	45.	24.	0.	11.3	83.5	55.	103.	-5.	12.3	81.2	70	95.	-5.	12.7	78.8	35.	270.	15.
112912Z	9.7	85.6	50	10.1	84.6	45.	64.	-5.	11.0	83.4	55	51	-10	11.9	81.1	70	101.	5.	12.2	78.8	35.	359.	15
112918Z	9.3	85.3	50	10.1	84.6	50.	63.	0	10.6	83.6	65	42.	0.	11.3	81.3	70.	210	40.	12.0	79.0	35.	468.	10.
113000Z	9.5	84.9	55	9.7	84.7	55.	17.	0.	9.4	83.7	75	124	5.	9.3	81.7	80	363.	60	9.7	78.9	50.	542.	20.
113006Z	9.9	84.5	60	9.6	84.8	60.	25.	0.	9.4	83.8	75.	201	0.	9.4	81.8	80.	453.	60	9.7	79.0	55.	618.	25.
113012Z	10.3	83.9	65	9.7	84.2	60.	40.	-5	10.7	82.2	75	175	10.	11.9	80.0	60	426.	40.	13.2	78.5	35.	656.	5.
113018Z	10.5	82.9	65	10.3	82.8	65.	13	0.	12.3	79.8	65	119	35.	14.0	78.0	35.	442	10.	0.0	0.0	0.	-0.	0.
120100Z	10.6	82.0	70	10.2	82.0	70	24.	0.	11.6	78.9	50	165	30	0.0	0.0	0.	-0	0	0.0	0.0	0.	-0.	0
120106Z	10.8	80.7	75	10.3	81.1	75.	38.	0.	11.3	78.2	30.	224.	10.	0.0	0.0	0	-0.	0.	0.0	0.0	0.	-0.	0
120112Z	11.7	79.4	65	10.9	79.8	65.	53.	0.	12.5	76.6	25.	238.	5	0.0	0.0	0	-0.	0.	0.0	0.0	0.	-0.	0.
120118Z	12.0	77.8	30	11.7	78.2	50.	30.	20.	0.0	0.0	0	-0.	0.	0.0	0.0	0.	-0.	0	0.0	0.0	0.	-0.	0.
120200Z	11.8	76.1	20	12.3	76.6	20	42.	0	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0	0.
120206Z	11.4	74.4	20	0.0	0.0	0	-0.	0	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0	0.0	0.0	0.	-0	0.
120212Z	11.1	72.8	20	0.0	0.0	0	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.
120218Z	11.0	71.1	25	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0	0	0.0	0.0	0.	-0.	0
120300Z	10.9	69.8	30	0.0	0.0	0	-0.	0.	0.0	0.0	0	-0	0.	0.0	0.0	0	-0	0	0.0	0.0	0	-0	0.
120306Z	10.9	68.6	30	0.0	0.0	0.	-0.	0	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0	0.0	0.0	0.	-0	0
120312Z	10.8	67.6	30	0.0	0.0	0	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0	0.
120318Z	10.7	66.5	35	11.3	66.0	35.	47	0.	12.3	61.2	55.	150.	0.	13.8	57.4	75.	347	15.	15.3	54.4	75.	464.	20
120400Z	10.5	65.5	40	11.4	64.7	40.	72.	0.	12.7	60.1	60	185	5.	14.1	56.5	75.	377	15.	15.2	53.6	75	462.	25.
120406Z	10.3	64.3	45	11.3	64.2	45.	60.	0.	11.8	60.9	65	185.	5.	13.0	57.5	75.	377.	15.	14.2	54.0	60	441.	25.
120412Z	10.1	63.3	50	10.4	62.9	45.	30.	-5.	10.6	59.3	65.	156.	5.	11.5	56.7	75.	321.	15.	12.4	54.9	65.	467	35.
120418Z	10.0	62.2	55	10.3	62.2	55.	18.	0.	10.4	58.8	75.	217.	15.	10.9	56.1	75.	320	20.	11.8	54.4	65.	514.	40.
120500Z	9.7	60.8	55	10.3	61.4	55.	51	0.	10.3	58.2	65.	251.	5.	10.7	55.4	70.	317.	20	11.3	52.7	75.	477.	55
120506Z	9.2	59.2	60	9.9	59.9	60.	59.	0.	10.1	55.9	70.	186.	10.	10.2	51.9	70.	172.	35.	0.0	0.0	0.	-0.	0
120512Z	8.7	57.5	60	8.8	58.0	60.	30.	0.	8.2	54.4	60.	113.	0.	8.0	49.7	35	67.	5.	0.0	0.0	0.	-0	0.
120518Z	8.2	55.9	60	8.4	55.8	60.	13.	0.	7.6	49.4	35.	128.	-20.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0	0
120600Z	8.1	54.6	60	8.0	54.0	60.	36.	0.	7.5	48.0	20.	169.	-30.	0.0	0.0	0.	-0.	0	0.0	0.0	0.	-0	0
120606Z	8.1	53.5	60	7.6	53.0	60.	42.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0	0.	0.0	0.0	0.	-0.	0
120612Z	8.1	52.5	60	8.0	52.2	60.	19.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0	0.	0.0	0.0	0.	-0.	0
120618Z	8.1	51.5	55	7.9	50.9	55.	38.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0	0.0	0.0	0.	-0	0
120700Z	8.0	50.8	50	8.1	50.1	50.	42.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0	-0	0	0.0	0.0	0.	-0	0
120706Z	7.8	50.3	35	7.9	50.4	40.	8.	5.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0	0.0	0.0	0	-0.	0.
120712Z	7.0	49.2	30	7.7	50.0	35.	63.	5.	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0	0.0	0.0	0.	-0	0
120718Z	5.7	48.3	25	7.0	49.2	25.	95.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0	-0.	0	0.0	0.0	0.	-0	0
120800Z	5.0	47.8	20	4.6	47.3	20.	38.	0.	0.0	0.0	0.	-0.	0	0.0	0.0	0.	-0	0	0.0	0.0	0	-0.	0
120806Z	4.7	47.0	15	0.0	0.0	0.	-0.	0.	0.0	0.0	0.	-0.	0.	0.0	0.0	0	-0.	0.	0.0	0.0	0	-0.	0

	ALL FORECASTS				TYPHOONS WHILE OVER 35 KTS			
	WRNG	24-HR	48-HR	72-HR	WRNG	24-HR	48-HR	72-HR
AVG FORECAST POSIT ERROR	38.	160.	271.	388.	0.	0.	0	0
AVG RIGHT ANGLE ERROR	17.	60.	123.	159.	0	0	0	0
AVG INTENSITY MAGNITUDE ERROR	1.	9.	19.	23.	0	0	0.	0
AVG INTENSITY BIAS	0.	4.	19.	15.	0	0.	0	0.
NUMBER OF FORECASTS	34	24	19	16	0	0	0	0

DISTANCE TRAVELED BY TROPICAL CYCLONE IS 2662. NM

AVERAGE SPEED OF TROPICAL CYCLONE IS 10. KNOTS

TC04B
FIX POSITIONS FOR CYCLONE NO. 4

SATELLITE FIXES

FIX NO	TIME (Z)	FIX POSITION		ACCRY	DVORAK CODE	COMMENTS	SITE
1	270448	8.3N	85.9E	PCN 5	T1.0/1.0	INIT OBS ULAC 08.4N 084.4E	KGUC
2	271729	9.3N	84.9E	PCN 6			KGUC
* 3	271800	8.9N	83.9E	PCN 6	T1.5/1.5	INIT OBS	PGTW
* 4	272140	9.5N	88.3E	PCN 4		ULAC 09.1N 086.3E	KGUC
5	280000	9.6N	85.2E	PCN 6			PGTW
* 6	280104	9.4N	88.1E	PCN 6			KGUC
7	280300	8.8N	84.8E	PCN 6	T2.0/2.0	INIT OBS ULAC 09.8N 084.8E	PGTW
8	280428	9.5N	85.6E	PCN 5	T2.5/2.5 /D1.5/24HRS	ULAC 10.2N 084.6E	KGUC
9	280600	9.0N	84.7E	PCN 6			PGTW
10	280900	9.2N	84.8E	PCN 6		ULCC FIX	PGTW
11	281025	9.8N	84.6E	PCN 5			KGUC
12	281200	10.2N	84.7E	PCN 6			PGTW
13	281203	10.4N	84.3E	PCN 5			KGUC
14	281600	10.3N	84.4E	PCN 6			PGTW
15	281708	10.6N	84.3E	PCN 5			KGUC
16	281800	10.4N	84.9E	PCN 6	T2.5/2.5 /D1.0/24HRS		PGTW
17	282100	10.4N	85.1E	PCN 6			PGTW
18	282310	10.0N	84.4E	PCN 5			KGUC
19	290000	10.6N	84.8E	PCN 6			PGTW
20	290043	10.1N	85.6E	PCN 6		ULAC 09.7N 084.9E	KGUC
21	290300	10.1N	84.6E	PCN 6	T3.0/3.0 /D1.0/24HRS	ULCC FIX	PGTW
22	290408	9.4N	85.5E	PCN 5	T3.0/3.0 /D0.5/24HRS		KGUC
23	290600	10.2N	84.5E	PCN 6		ULCC FIX	PGTW
24	290900	10.1N	84.3E	PCN 6		ULCC FIX	PGTW
25	291013	9.5N	85.2E	PCN 5		ULAC 09.7N 085.4E	KGUC
26	291200	9.6N	84.6E	PCN 6			PGTW
27	291323	9.2N	86.4E	PCN 5			KGUC
28	291600	9.6N	85.1E	PCN 6			PGTW
29	291648	9.7N	85.7E	PCN 6			KGUC
30	291800	9.9N	85.1E	PCN 6	T3.5/3.5 /D1.0/24HRS		PGTW
31	292100	10.0N	84.8E	PCN 6			PGTW
32	292258	9.7N	84.9E	PCN 5	T3.5/3.5 /D1.0/24HRS		FJDG
33	300000	9.6N	84.6E	PCN 6		ULCC FIX	PGTW
34	300021	9.7N	85.2E	PCN 5			KGUC
35	300300	9.6N	84.8E	PCN 6	T4.0/4.0 /D1.0/24HRS		PGTW
36	300347	9.5N	84.9E	PCN 5	T3.5/3.5 /D0.5/24HRS		KGUC
37	300600	9.6N	84.8E	PCN 6			PGTW
38	300900	9.6N	84.1E	PCN 6			PGTW
39	301000	10.0N	84.4E	PCN 6			KGUC
40	301200	10.2N	83.6E	PCN 6			PGTW
41	301301	10.4N	83.7E	PCN 6			KGUC
42	301622	10.7N	82.8E	PCN 6			KGUC
43	010000	10.0N	81.7E	PCN 2			KGUC
44	010000	10.7N	82.1E	PCN 6			PGTW
45	010300	10.3N	81.4E	PCN 6	T4.5/4.5 /D0.5/24HRS		PGTW
46	010506	10.6N	81.2E	PCN 5			KGUC
47	010600	10.9N	81.1E	PCN 6		ULCC FIX	PGTW
48	010900	10.5N	80.3E	PCN 6		ULCC FIX	PGTW
49	010942	11.1N	79.1E	PCN 6			KGUC
50	011200	10.8N	80.1E	PCN 6		ULCC FIX	PGTW
51	011240	11.6N	78.4E	PCN 6			KGUC
* 52	[illegible]	[illegible]	77.3E	PCN 5			KGUC
53	[illegible]	14.2N	75.7E	PCN 6			KGUC
54	[illegible]	11.2N	74.9E	PCN 5			KGUC
55	020448	11.3N	74.2E	PCN 5	T0.0/1.5 /W3.5/24HRS		KGUC
56	021400	11.2N	72.0E	PCN 5			KGUC
57	[illegible]	11.4N	71.1E	PCN 5			KGUC
58	[illegible]	10.8N	69.7E	PCN 5			FJDG
59	[illegible]	11.0N	69.5E	PCN 5		ULAC 10.9N 070.2E	KGUC

60	030609	11 0N	69.4E	PCN 5	T2.5/2.5 /D2.5/25HRS	ULAC 10.4N 069.4E	KGWC
61	031104	11.1N	68.0E	PCN 5			KGWC
62	031105	11 2N	67.9E	PCN 3	T2.0/2.0+/S0.5/11HRS		FJDG
63	031339	11 2N	67.4E	PCN 5		ULAC 11.0N 067.8E	KGWC
64	031709	11 1N	66.1E	PCN 5			KGWC
65	032349	10 8N	65.6E	PCN 5			KGWC
66	040219	10 2N	65.7E	PCN 5			KGWC
67	040549	9.7N	64.0E	PCN 5	T3.0/3.0 /D0.5/24HRS	ULAC 10.0N 064.1E	KGWC
68	041052	9.9N	63.3E	PCN 5			KGWC
69	041052	10.6N	62.5E	PCN 5			FJDG
70	041457	9.9N	62.7E	PCN 5			KGWC
71	041830	9.9N	62.2E	PCN 5	T3.5/3.5	INIT OBS ULAC 09.1N 061.8E	KGWC
72	042337	10.0N	61.2E	PCN 5		ULAC 09.6N 061.3E	KGWC
73	042338	11.0N	59.0E	PCN 4	T3.0/3.0		FJDG
74	050158	9.3N	60.0E	PCN 5			KGWC
75	050529	9.0N	59.3E	PCN 5	T4.0/4.0 /D1.0/24HRS		KGWC
76	051224	8 2N	57.3E	PCN 5			KGWC
77	051438	8.1N	56.6E	PCN 5			KGWC
* 78	051515	9.7N	56.6E	PCN 5			FJDG
79	051810	8.5N	55.1E	PCN 5			KGWC
80	060318	7.5N	54.4E	PCN 5			KGWC
81	060650	8.6N	53.4E	PCN 5	T3.5/4.0 /W0.5/24HRS	ULAC 08.0N 053.7E	KGWC
82	061417	8.1N	51.5E	PCN 5			KGWC
83	061931	8.2N	51.2E	PCN 5	T3.0/4.0 /W1.0/25HRS		KGWC
84	070257	8.2N	49.7E	PCN 5		ULAC 08.1N 049.6E	KGWC
85	070630	7.6N	50.4E	PCN 3	T1.5/2.5 /W1.5/24HRS	EXP LLCC ULAC 08.1N 048.3E	KGWC
86	071537	6.2N	48.9E	PCN 5		EXP LLCC ULAC 09.2N 047.1E	KGWC
87	071911	5.5N	47.9E	PCN 5		EXP LLCC ULAC 10.0N 047.0E	KGWC
88	080235	5.1N	46.8E	PCN 5		EXP LLCC	KGWC
89	080751	5.1N	46.7E	PCN 5			KGWC

SYNOPTIC FIXES

FIX NO.	TIME (Z)	FIX POSITION		INTENSITY ESTIMATE	NEAREST DATA (NM)	COMMENTS
1	011200	11.5N	79.2E	065	060	43344 43295 43279
2	011500	12.1N	78.8E	060	090	43295 43279 42245
3	011800	11.5N	77.8E	050	060	43321 43344 43279 43295
4	020000	12.2N	77.0E	020	040	43295 43284 43279 43201

NOTICE - THE ASTERISKS (*) INDICATE FIXES UNREPRESENTATIVE AND NOT USED FOR BEST TRACK PURPOSES.

APPENDIX I
CONTRACTIONS

ACCRY	Accuracy
ACFT	Aircraft
ADP	Automated Data Processing
AFGWC	Air Force Global Weather Central
AIREP	Aircraft Weather Report(s) (Commercial and Military)
ANT	Antenna
AOR	Area of Responsibility
APRNT	Apparent
APT	Automatic Picture Transmission
ARWO	Aerial Reconnaissance Weather Officer
ATT	Attenuation
AVG	Average
AWN	Automated Weather Network
BPAC	Blended Persistence and Climatology
BRG	Bearing
CDO	Central Dense Overcast
CI	Cirriform Cloud or Cirrus also Current Intensity (Dvorak)
USCINCPAC	Commander-in-Chief Pacific AF - Air Force, FLT - Fleet (Navy)
CLD	Cloud
CLIM	Climatology
CLSD	Closed
CM	Centimeter
CNTR	Center
CPA	Closest Point of Approach
CSC	Cloud System Center
CYCLOPS	Tropical Cyclone Steering Program (HATTRACK and MOHATT)
DEG	Degree(s)
DIAM	Diameter
DIR	Direction
DMSP	Defense Meteorological Satellite Program
DST	Distance
EL	Elongated
ELEV	Elevation
EXP	Exposed

FI	Forecast Intensity (Dvorak)
FLT	Flight
FNOC	Fleet Numerical Oceanography Center
FT	Feet
GMT	Greenwich Mean Time
GOES	Geostationary Operational Environmental Satellite
HATTRACK	Hurricane and Typhoon Tracking (Steering) Program
HGT	Height
HPAC	Mean of XTRP and CLIM Techniques (Half Persistence and Climatology)
HR(s)	Hour(s)
HVY	Heavy
ICAO	International Civil Aviation Organization
INIT	Initial
INJAH	North Indian Ocean Component of TYAN
INST	Instruction
IR	Infrared
KM	Kilometer(s)
KT	Knot(s)
LLCC	Low-level Circulation Center
LVL	Level
M	Meter(s)
M/S	Meter(s) per Second
MAX	Maximum
MB	Millibar(s)
MET	Meteorological
MIN	Minimum
MOHATT	Modified HATTRACK
MOVG	Moving
MSLP	Minimum Sea Level Pressure
MSN	Mission
NAV	Navigational
NEDN	Naval Environmental Data Network
NEDS	Naval Environmental Display Station

NEPRF	Naval Environmental Prediction Research Facility
NESS	National Environmental Satellite Service
NESDIS	National Environmental Satellite, Data, and Information Service
NET	Near Equatorial Trough
NM	Nautical Mile(s)
N/O	Not Observed
NOAA	National Oceanic and Atmospheric Administration
NOCC	Naval Oceanography Command Center
NOGAPS	Navy Operational Global Atmospheric Prediction System
NWOC	Naval Western Oceanography Center
NR	Number
NRL	Naval Research Laboratory
NTCM	Nested Tropical Cyclone Model
OBS	Observations
OTCM	One-Way (Interactive) Tropical Cyclone Model
PACOM	Pacific Command
PCN	Position Code Number
PSBL	Possible
PTLY	Partly
QUAD	Quadrant
RADOB	Radar Observations
RECON	Reconnaissance
RNG	Range
RT	Right
SAT	Satellite
SFC	Surface
SLP	Sea Level Pressure
SPOL	Spiral Overlay
SRP	Selective Reconnaissance Program
STNRY	Stationary
SST	Sea Surface Temperature
ST	Subtropical
STR	Subtropical Ridge
STY	Super Typhoon
TAPT	*Typhoon Acceleration Prediction* Technique
TC	Tropical Cyclone
TCARC	Tropical Cyclone Aircraft Reconnaissance Coordinator
TCFA	Tropical Cyclone Formation Alert
TCM	Tropical Cyclone Model
TD	Tropical Depression
TDO	Typhoon Duty Officer
TIROS	Television Infrared Observation Satellite
TPAC	Extrapolation and Climatology blend
TS	Tropical Storm
TY	Typhoon
TYAN	Typhoon Analog Program
TYFN	Western North Pacific Component (Revised) of TYAN
TUTT	Tropical Upper-Tropospheric Trough
ULAC	Upper-level Anticyclone
ULCC	Upper-level Circulation Center
VEL	Velocity
VIS	Visual
VMNT	Vector Movement (ddff)
WESTPAC	Western (North) Pacific
WMO	World Meteorological Organization
WND	Wind
WRNG(s)	Warning(s)
WRS	Weather Reconnaissance Squadron
XTRP	Extrapolation
Z	Zulu Time (Greenwich Mean Time)

APPENDIX II
DEFINITIONS

BEST TRACK - A subjectively smoothed path, versus a precise and very erratic fix-to-fix path, used to represent tropical cyclone movement.

CENTER - The vertical axis or core of a tropical cyclone. Usually determined by wind, temperature, and/or pressure distribution.

CYCLONE - A closed atmospheric circulation rotating about an area of low pressure (counterclockwise in the Northern Hemisphere).

EPHEMERIS - Position of a body (satellite) on space as a function of time; used for gridding satellite imagery. Since ephemeris gridding is based solely on the predicted position of the satellite, it is susceptible to errors from vehicle pitch, orbital eccentricity, and the oblateness of the earth.

EXPLOSIVE DEEPENING - A decrease in the minimum sea level pressure of a tropical cyclone of 2.5 mb/hr for 12 hrs or 5.0 mb/hr for six hrs (ATR 1971).

EXTRATROPICAL - A term used in warnings and tropical summaries to indicate that a cyclone has lost its "tropical" characteristics. The term implies both poleward displacement from the tropics and the conversion of the cyclone's primary energy sources from release of latent heat of condensation to baroclinic processes. The term carries no implications as to strength or size.

EYE - A term used to describe the central area of a tropical cyclone when it is more than half surrounded by wall cloud.

FUJIWHARA EFFECT - An interaction in which tropical cyclones within about 700 nm (1296 km) of each other begin to rotate about one another. When intense tropical cyclones are within about 400 nm (741 km) of each other, they may also begin to move closer to each other.

MAXIMUM SUSTAINED WIND - Highest surface wind speed averaged over a one-minute period of time. Peak gusts over water average 20 to 25 percent higher than sustained winds.

RAPID DEEPENING - A decrease in the minimum sea level pressure of a tropical cyclone of 1.25 mb/hr for 24 hrs (ATR 1971).

RECURVATURE - The turning of a tropical cyclone from an initial path toward the west or northwest to a path toward the northeast.

RIGHT ANGLE ERROR - The distance described by a perpendicular line from the best track to a forecast position. (See figure 4-1).

SIGNIFICANT TROPICAL CYCLONE - A tropical cyclone becomes "significant" with the issuance of the first numbered warning by the responsible warning agency.

SUPER TYPHOON/HURRICANE - A typhoon/hurricane in which the maximum sustained surface wind (one-minute mean) is 130 kt (67 m/s) or greater.

TROPICAL CYCLONE - A non-frontal low pressure system of synoptic scale developing over tropical or subtropical waters and having a definite organized circulation.

TROPICAL CYCLONE AIRCRAFT RECONNAISSANCE COORDINATOR - A USCINCPACAF representative designated to levy tropical cyclone aircraft weather reconnaissance requirements on reconnaissance units within a designated area of the PACOM and to function as coordinator between USCINCPACAF, aircraft weather reconnaissance units, and the appropriate typhoon/hurricane warning center.

TROPICAL DEPRESSION - A tropical cyclone in which the maximum sustained surface wind (one-minute mean) is 33 kt (17 m/s) or less.

TROPICAL DISTURBANCE - A discrete system of apparently organized convection---generally 100 to 300 nm (185 to 556 km) in diameter--originating in the tropics or subtropics, having a non-frontal migratory character, and having maintained its identity for 24 hours or more. It may or may not be associated with a detectable perturbation of the wind field. As such, it is the basic generic designation which, in successive stages of intensification, may be classified as a tropical depression, tropical storm or typhoon (hurricane).

TROPICAL STORM - A tropical cyclone with maximum sustained surface winds (one-minute mean) in the range of 34 to 63 kt (17 to 32 m/s) inclusive.

TROPICAL UPPER-TROPOSPHERIC TROUGH (TUTT) - "A dominant climatological system, and a daily synoptic feature, of the summer season over the tropical North Atlantic, North Pacific and South Pacific Oceans," from Sadler, J.C., Feb. 1976: Tropical Cyclone Initiation by the Tropical-Upper Tropospheric Trough (NAVENVPREDRSCHFAC Technical Paper No. 2-76).

TYPHOON/HURRICANE - A tropical cyclone in which the maximum sustained surface wind (one-minute mean) is 64 kt (33 m/s) or greater. West of 180 degrees longitude they are called typhoons and east of 180 degrees they are called hurricanes. Foreign governments use these or other terms for tropical cyclones and may apply different intensity criteria.

VECTOR ERROR - The distance described by a straight line from the forecast position to the position at verification time as found on the best track. (See Figure 4-1).

WALL CLOUD - An organized band of cumuliform clouds immediately surrounding the central area of a tropical cyclone. The wall cloud may entirely enclose or only partially surround the center.

APPENDIX III
NAMES FOR TROPICAL CYCLONES

Column 1	Column 2	Column 3	Column 4
ANDY	ABBY	ALEX	AGNES
BRENDA	BEN	BETTY	BILL
CECIL	CARMEN	CARY	CLARA
DOT	DOM	DINAH	DOYLE
ELLIS	ELLEN	ED	ELSIE
FAYE	FORREST	FREDA	FABIAN
GORDON	GEORGIA	GERALD	GAY
HOPE	HERBERT	HOLLY	HAL
IRVING	IDA	IKE	IRMA
JUDY	JOE	JUNE	JEFF
KEN	KIM	KELLY	KIT
LOLA	LEX	LYNN	LEE
MAC	MARGE	MAURY	MAMIE
NANCY	NORRIS	NINA	NELSON
OWEN	ORCHID	OGDEN	ODESSA
PEGGY	PERCY	PHYLLIS	PAT
ROGER	RUTH	ROY	RUBY
SARAH	SPERRY	SUSAN	SKIP
TIP	THELMA	THAD	TESS
VERA	VERNON	VANESSA	VAL
WAYNE	WYNNE	WARREN	WINONA

NOTE:

Names are assigned in rotation, alphabetically. When the last name (WINONA) has been used, the sequence will begin again with "ANDY".

Source: CINCPACINST 3140.1 (series)

APPENDIX IV
REFERENCES

Atkinson, G. D., and C. R. Holliday, 1977: Tropical Cyclone Minimum Sea Level Pressure - Maximum Sustained Wind Relationship for the Western North Pacific. Monthly Weather Review, Vol. 105, No. 4, pp. 421-427.

Dunnavan, G. M., 1981: Forecasting Intense Tropical Cyclones Using 700 MB Equivalent Potential Temperature and Central Sea Level Pressure. NAVOCEANCOMCEN/JTWC TECH NOTE: JTWC 81-1, 12 pp.

Dvorak, V. F., 1973: A Technique for the Analysis and Forecasting of Tropical Cyclone Intensities from Satellite Pictures. NOAA Technical Memorandum NESS 45, 19 pp. (Note: Updated info in May 1982 Training Notes and Appendix: Tropical Cyclone Intensity Analysis and Forecasting from Satellite Visible or Enhanced Infrared Imagery).

Holland, G. J., 1980: An Analytic Model of the Wind and Pressure Profiles in Hurricanes. Monthly Weather Review, Vol 108, No. 8, pp. 1212-1218.

Sadler, J. C., 1976: Tropical Cyclone Initiation by the Tropical Upper-Tropospheric Trough. NAVENVPREDRSCHFAC Technical Paper No. 2-76, 103 pp.

Sikora, C. R., 1976: An Investigation of Equivalent Potential Temperature as a Measure of Tropical Cyclone Intensity. FLEWEACEN TECH NOTE: JTWC 76-3, 12 pp.

Weir, R. C., 1982: Predicting the Acceleration of Northward-moving Tropical Cyclones Using Upper-Tropospheric Winds. NAVOCEANCOMCEN/JTWC TECH NOTE: NOCC/JTWC 82-2.

APPENDIX V
PAST ANNUAL TROPICAL CYCLONE REPORTS

Copies of the past Annual Tropical Cyclone/Typhoon Reports can be obtained through:

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20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

Annual publication summarizing the tropical cyclone season in the western North Pacific, Bay of Bengal and Arabian Sea. A brief narrative is given on each significant tropical cyclone including its best track. All reconnaissance data used to construct the best tracks are provided. Forecast verification data and statistics for the JTWC are summarized.

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Block 19, (Continued)

Dynamic tropical cyclone models
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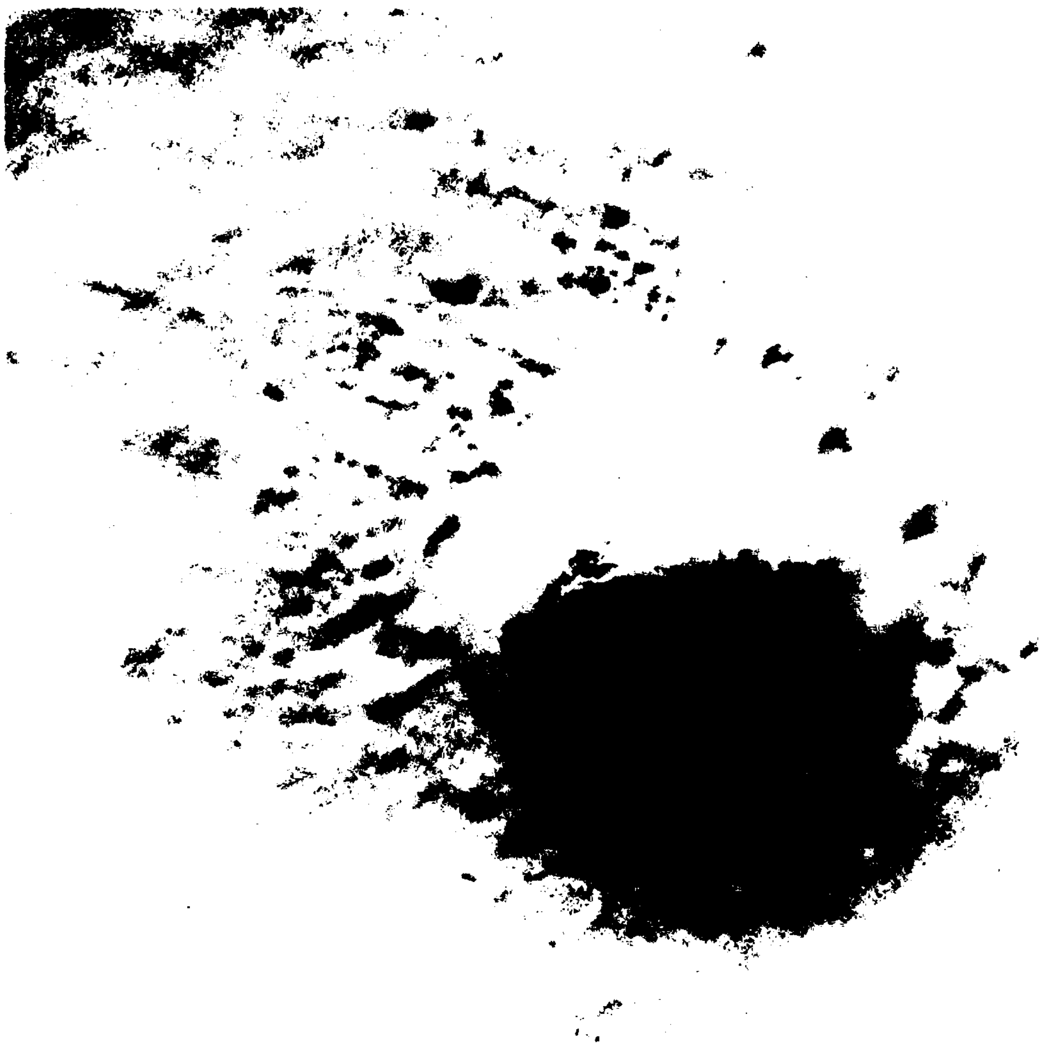

Tropical Cyclone 30S (Kamisy) on 9 April 1984, one day after the front cover photograph. Mission 41C orbit was directly over the storm. This nadir view was taken with a 250 mm lens. To give a sense of size, the picture is approximately 55 by 55 nm (102 by 102 km). The eye diameter is 10 nm (19 km). Note the overshooting tops through the tropopause in the eyewall convection. The resolution with this lens is 40 to 50 meters. (Photograph provided by LCDR W. T. Aldinger, NAVPOLAROCEANCEN Detachment, Johnson Space Center, Texas).

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